

UNIFIED FACILITIES CRITERIA (UFC)

DESIGN: PASSIVE SOLAR BUILDINGS



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AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY

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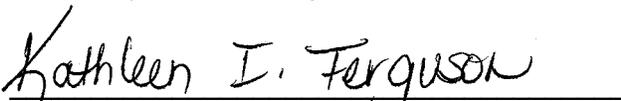
- Unified Facilities Criteria (UFC) Index http://65.204.17.188/report/doc_ufc.html.
- USACE TECHINFO Internet site <http://www.hnd.usace.army.mil/techinfo/index.htm>.
- NAVFAC Engineering Innovation and Criteria Office Internet site <http://criteria.navfac.navy.mil>.
- Construction Criteria Base (CCB) system maintained by the National Institute of Building Sciences at Internet site <http://www.nibs.org/ccb>.

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CHAPTER 1

INTRODUCTION

1-1 **PURPOSE AND SCOPE.** This UFC is comprised of two sections. Chapter 1 introduces this UFC and provides a listing of references to other Tri-Service documents closely related to the subject. Appendix A contains the full text copy of the previously released Military Handbook (MIL-HDBK) on this subject. This UFC serves as criteria until such time as the full text UFC is developed from the MIL-HDBK and other sources.

This UFC provides general criteria for the design of passive solar buildings.

Note that this document does not constitute a detailed technical design, maintenance or operations manual, and is issued as a general guide to the considerations associated with design of economical, efficient and environmentally acceptable heating plants.

1-2 **APPLICABILITY.** This UFC applies to all Navy service elements and Navy contractors; Army service elements should use the references cited in paragraph 1-3 below; all other DoD agencies may use either document unless explicitly directed otherwise.

1-2.1 **GENERAL BUILDING REQUIREMENTS.** All DoD facilities must comply with UFC 1-200-01, *Design: General Building Requirements*. If any conflict occurs between this UFC and UFC 1-200-01, the requirements of UFC 1-200-01 take precedence.

1-2.2 **SAFETY.** All DoD facilities must comply with DODINST 6055.1 and applicable Occupational Safety and Health Administration (OSHA) safety and health standards.

NOTE: All **NAVY** projects, must comply with OPNAVINST 5100.23 (series), *Navy Occupational Safety and Health Program Manual*. The most recent publication in this series can be accessed at the NAVFAC Safety web site: www.navfac.navy.mil/safety/pub.htm. If any conflict occurs between this UFC and OPNAVINST 5100.23, the requirements of OPNAVINST 5100.23 take precedence.

1-2.3 **FIRE PROTECTION.** All DoD facilities must comply with UFC 3-600-01, *Design: Fire Protection Engineering for Facilities*. If any conflict occurs between this UFC and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence.

1-2.4 **ANTITERRORISM/FORCE PROTECTION.** All DoD facilities must comply with UFC 4-010-01, *Design: DoD Minimum Antiterrorism Standards for Buildings*. If any conflict occurs between this UFC and UFC 4-010-01, the requirements of UFC 4-010-01 take precedence.

APPENDIX A

**MIL-HDBK 1003/19
PASSIVE SOLAR BUILDINGS**

MILITARY HANDBOOK
DESIGN PROCEDURES FOR
PASSIVE SOLAR BUILDINGS

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DEPARTMENT OF DEFENSE
Washington, DC 20301

Passive Solar Design Procedures

1. This military handbook is approved for use by all Departments and Agencies of the Department of Defense.
2. Beneficial suggestions (reccomendations, additions, deletions) and any pertinent data which may be of use in improving this document shaould be addressed to: Commanding Officer, (Code 156), Naval Construction Battalion Center, Port Hueneme, CA 93043-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FOREWORD

The energy efficiency of buildings at Naval installations can be greatly improved through the use of passive solar heating strategies. These strategies are universally applicable to new buildings of small to moderate size and are also applicable to many existing buildings that are suitable for retrofit. The purpose of this handbook is to provide the tools needed by professionals involved in building design and/or evaluation who wish to reduce the consumption of non-renewable energy resources for space heating. Three types of tools are provided. First, a general discussion of the basic concepts and principles of passive solar heating is presented to familiarize the reader with this technology. Second, a set of guidelines is presented for use during schematic design or for initial screening if an evaluation is being performed. These guidelines enable the user to quickly define a building that will perform in a cost effective manner at the intended building site. Finally, a quantitative design-analysis procedure is presented that enables the user to obtain an accurate estimate of the auxiliary heating requirements of a particular passive solar design. This procedure may be used to refine a schematic design based on the guidelines already mentioned, or may be used to compare the merits of candidate designs in a proposal evaluation.

These design procedures are an extension and refinement of an earlier five-volume set of publications entitled "Design Calculation Procedure for Passive Solar Houses at Navy Installations in:

Regions with Cold Climates - Volume I" CR 82.002
East Coast Regions with Temperate Climates - Volume II" CR 82.003,
Regions with Warm Humid Climates - Volume III" CR 82.004,
The Pacific Northwest - Volume IV" CR 82.005,
Warm California Climates - Volume V" CR 82.006.

The following improvements and additions should increase the usefulness of the new manual:

- o The design analysis procedure has been streamlined and is much faster than the original method.
- o Performance correlations for 187 reference passive solar designs representing eight different types of systems are now available.
- o The design procedure has been generalized by characterizing different climates with appropriate weather parameters, thereby eliminating the need for separate regional documents.
- o The new document is applicable to townhouses and larger dormitory-type buildings as well as detached single-family residences. Office buildings or other structures of moderate size are also amenable to analysis by the new procedures.
- o Performance correlations for passive solar retrofits to concrete block and metal buildings are included in the manual. Because of the prevalence of these types of construction at Naval installations, the retrofit correlations should be especially useful.

- o Procedures for estimating and minimizing the incremental cooling load associated with passive heating systems are provided.
- o A procedure for estimating the effect of control strategy on performance is provided.

The present form of the design procedures may be updated in succeeding years as the results of future research become available. In particular, a quantitative treatment of passive cooling strategies is planned. In the meantime, this edition will enable the user to design or retrofit buildings in a manner that greatly reduces the use of non-renewable energy resources for space heating.

Acknowledgments. This Military Handbook is a result of a cooperative effort between the Naval Civil Engineering Laboratory (NCEL) and Los Alamos National Laboratory (LANL). The NCEL personnel include Edward R. Durlak and Charles R. Miles. The LANL personnel include W. O. Wray (principal author), and Claudia Peck, Elaine Best, Bob Jones, Doug Balcomb, Gloria Lazarus, Bob McFarland, Franz Biehl, and Horn Schnurr.

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1. SCOPE

1.1 Passive solar buildings: A general description. A passive solar building is one that derives a substantial fraction of its heat from the sun using only natural processes to provide the necessary energy flows. Thermal conduction, free convection, and radiation transport therefore replace the pumps, blowers, and controllers associated with active solar heating systems. The elements of a passive solar heating system tend to be closely integrated with the structure for which heat is provided. South facing windows, for example, may serve as apertures through which solar energy is admitted to the building, and thermal storage may be provided by inherent structural mass. Solar radiation absorbed inside the building is converted to heat, part of which meets the current heat load whereas the remainder is stored in the structural mass for later use after the sun has set.

Because of the integral nature of passive solar buildings, it is not possible to design the structure independent of the heating system as is usually done with active systems. Instead, it is necessary to consider the solar characteristics of the building from the initial phases of the design process to completion of the construction documents. A well designed passive solar building is comfortable, energy efficient, and very reliable because of its inherent operational simplicity. However, a poor design, lacking some or all of these desirable characteristics, may be very difficult to modify after construction is complete and the problems become manifest. It has therefore been necessary to develop a new approach to building design that couples solar/thermal considerations with the more traditional concerns of form and structure.

This document does not address daylighting in a quantitative manner nor does it deal with passive cooling as a design strategy. However, the extent to which the summer cooling load may be aggravated by passive heating systems is quantified and various countermeasures are suggested.

1.2 Purpose of the design procedures. The purpose of these procedures is to make the results of recent scientific research on passive solar energy accessible to professionals involved in building design or design evaluation. By so doing, this new technology can be transferred from the research laboratory to the drawing board and the construction site. A successful transfer will undoubtedly improve the energy efficiency of new buildings as well as many existing buildings that are suitable for retrofit.

This document is addressed principally to prospective Navy contractors for design and construction of passive solar buildings. However, because good passive solar designs are of little value if they are rejected in favor of more conventional but less efficient structures, the design analysis procedures presented herein are also intended for use by engineers and architects involved in the evaluation process. The calculations that are involved are based on the use of simple tables and graphs. An arithmetical calculator is the only tool required.

1.3 Organization and use of the design procedures. The material in this handbook is organized such that there is a progression from general principles at the beginning to more detailed and specific information toward the

conclusion. This organization parallels the architectural design process whereby the designer begins with gross building characteristics in schematic design, proceeds to refinements and more detail in design development, and finally completes the design with construction documents. This handbook provides step by step procedures for establishing the solar/thermal characteristics of a building during schematic design and design development. Worksheets are provided throughout as aids to the user in following the design procedures quickly and accurately.

In 4.1, the basic concepts describing the physical characteristics and operating principles of the various types of passive solar heating systems are addressed. The cooling implications of using these systems on buildings is also discussed in general terms. This section should provide the background needed before proceeding to a discussion of climatic considerations in 4.2.

In 4.2, variations in climate and the broad implications of those variations for passive solar design are addressed. Two contour maps of the continental United States are presented. The first map divides the country into four climate regions based on the importance of conservation measures for reducing the space heating load of buildings; the four regions are thus indicative of the severity of the winter climate. The second map defines five-climate regions on the basis of availability of solar energy as a space heating resource. These two maps help one develop a feel for the geographic distribution of passive solar potential because areas of high potential are those in which severe winter conditions coincide with high solar availability.

Guidelines for schematic design are presented in 4.3. These guidelines will enable the designer to specify the gross characteristics of a building in a manner that assures good solar/thermal performance in a specified climate region. Alternately, the guidelines are appropriate for use as evaluation tools during the initial screening of designs submitted by prospective contractors. In either case, final decisions should be deferred until a complete design analysis, as described in 4.4 and 5.1, has been performed to fine tune a design under development or to evaluate each candidate design surviving the initial screening of contractor proposals.

The introduction to design analysis (4.4) is intended to prepare the reader for subsequent applications. Applied design analysis procedures appropriate for use during design development are presented in 5.1. Worksheets are provided that enable the user to estimate auxiliary heat requirements, assess potential winter overheating problems, determine the incremental cooling load, and evaluate the cost effectiveness of the system. Procedures for refining the design on the basis of analysis results are reviewed in 5.2.

In 5.3, example calculations are presented that illustrate application of the design procedures to a four plex family housing unit. This realistic example should prepare the reader for his first experience with passive solar design or evaluation. Finally, a summary of the important points to remember is presented in 5.4.

This handbook should provide enough information and guidance to enable a designer to produce cost effective, energy efficient passive solar buildings at any point in the continental United States.

2. REFERENCED DOCUMENTS.

2.1 Other Government publications. The following other Government documents publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

NAVAL CIVIL ENGINEERING LABORATORY

- CR 82.002 - Design Calculation Procedure for Passive Solar Houses in Regions with Cold Climate, Volume I.
- CR 82.003 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in East Coast Regions with Temperate Climate, Volume II.
- CR 82.004 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in Regions with Warm, Humid Climate, Volume III.
- CR 82.005 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in the Pacific Northwest, Volume IV.
- CR 82.006 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in Warm California Climates, Volume V.
- CR 83.040 - Passive Solar Design Procedures for Naval Installations.

(Application for copies should be addressed to NCEL, Port Hueneme, CA 93041.)

DEPARTMENT OF ENERGY
LOS ALAMOS NATIONAL LABORATORY (LANL)

- DOE/CS-0127/2 - Passive Solar Design Handbook, Volume Two.
- DOE/CS-0127/3 - Passive Solar Design Handbook, Volume Three.

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Copies of publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The documents cited in this section are for guidance and information.

American Society of Heating, Refrigeration, and Air Conditioning Engineers Handbook (ASHRAE), 1977 Fundamentals Volume.

ASHRAE Journal. (N. E. Hager, Jr.) December 1983, pp. 29-32.

Input Data for Solar Systems. (V. Cinquemani, J. R. Owenby, and R. G. Baldwin) Ashville, NC, National Climatic Center, November 1978.

Generation of Typical Meteorological Years for 26 SOLMET Stations.
(I. Hall, R. Prarie, H. Anderson, and Eldon Boes) SAND78-1601,
Albuquerque, Sandia Laboratories, August 1978.

Thermal Shutters and Shades. (William A. Surcliff) Brickhouse
Publishing Company, Andover, Massachusetts, 1980.

"How to Design Fixed Overhangs". (Andrew Lau) Solar Age, February 1983,
pp 32-38.

(Non-Government standards and other publications are normally available
from the organizations which prepare or which distribute the documents.
These documents also may be available in or through libraries or other
informational services.)

2.3 Order of precedence. In the event of a conflict between the text
of this specification and the references cited herein (except for associated
detail specifications, specification sheets or MS standards), the text of
this specification shall take precedence. Nothing in this specification,
however, shall supersede applicable laws and regulations unless a specific
exemption has been obtained.

3. DEFINITIONS

3.1 Definitions of acronyms and symbols used in this handbook.

[alpha]	- solar aperture absorptance.
[alpha] _{ir}	- infrared absorptance.
[W-DELTA]T _I	- temperature increment without ventilation (deg.F).
[theta]	- tilt of solar collector relative to vertical plane (degrees).
[rho]	- density (lb/ft ³).
[tau]	- building time constant (hr).
[open phi]	- azimuth of solar collector (degrees).
a	- city parameter.
A _a	- actual roof area (ft ²).
A _c	- solar collection area (ft ²).
(A _c /A _f) ₀	- reference ratio of collector area to floor area.
A _e	- external surface area of a building or thermal zone (ft ²).
A _f	- heated floorspace (ft ²).
A _g	- ground floor area (ft ²).
A _i	- mass area of element i (ft ²).
A _m	- thermal storage mass surface area (ft ²).
A _n	- non-south window area (ft ²).
A _p	- projected area of solar collection aperture on a vertical plane (ft ²).
A _r	- roof area projected on a horizontal plane (ft ²).
A _s	- total south wall area (ft ²).
A _w	- wall area (ft ²).
ACH	- air changes per hour.
ADR	- air density ratio.

c	- specific heat (Btu/lb-deg.F).
C	- capital invested (\$).
D	- solar declination (degrees).
DF	- diurnal heat capacity thickness function.
DD	- heating degree days (deg.F-day).
DD _{ra}	- annual heating degree days (deg.F-day/yr).
DD _{fact}	- annual heating degree days based on actual average indoor temperature (deg.F-day/yr).
DD _m	- heating degree days for harshest winter month in a particular location (deg.F-day/month).
DHC	- diurnal heat capacity (Btu/deg.F).
e _d	- delivery efficiency.
e _t	- total system efficiency.
e _u	- utilization efficiency.
(e _u) _{ra}	- annual utilization efficiency.
E	- annual energy saved (MMBtu/yr).
EF	- effective heat capacity heat thickness function.
EF _i	- effective heat capacity heat thickness function for element i.
EHC	- effective heat capacity (Btu/deg.F).
f	- area factor.
F	- scale factor.
G	- effective aperture conductance (Btu/deg.F-day ft ²).
h	- ceiling height (ft).
hr	- duration (hours).
k	- thermal conductivity (Btu/deg.F-ft-hr).
K _b	- frontflow/backflow parameter for thermosiphoning air panels.
l	- thickness (ft).

L	- latitude (degrees).
LC	- load coefficient (Btu/deg.F-day).
LCR	- load collector ratio (Btu/deg.F-day ft ²).
m	- reference month.
N	- number of months in heating season.
NGL	- number of glazings.
NGL _n	- number of glazings of nonsouth windows.
NLC	- net load coefficient (Btu/deg.F-day).
NLC _e	- exterior zone (Btu/deg.F-day).
NLC _i	- interior zone (Btu/deg.F-day).
NSF	- non-south window fraction.
NZONE	- number of zones.
P	- period of diurnal cycle.
P _g	- ground floor perimeter (ft).
P _t	- total external perimeter of the heated floorspace (ft).
PR	- productivity (Btu/ft ²).
Q _{act}	- actual annual heating load (Btu/yr).
Q _A	- auxiliary heat requirement (Btu).
(Q _A) _a	- annual auxiliary heat requirement (Btu).
Q _D	- delivered solar energy (Btu).
(Q _D) _a	- annual delivered solar energy (Btu).
Q _E	- excess solar energy during reference month (Btu)
Q _I	- annual incremental cooling load (Btu).
Q _{int}	- internal heat generation rate (Btu/day).
Q _L	- effective building heat load (Btu).
(Q _L) _a	- annual effective building heat load (Btu).

$Q_{\Gamma N\gamma}$	- net building heat load (Btu).
$Q_{\Gamma S\gamma}$	- utilizable solar heat (Btu).
$Q_{\Gamma SL\gamma}$	- steady state building heat load (Btu).
QS	- monthly solar radiation transmitted through an arbitrarily oriented solar collector (Btu/ft ² -month).
QSA	- annual solar radiation transmitted through an arbitrarily oriented solar collector (Btu/ft ² -yr).
QTAN	- annual solar radiation transmitted through a vertical, south facing aperture with n glazings arbitrarily oriented (Btu/ft ² -yr).
$R_{\Gamma d\gamma}$	- thermal resistance of decorative floor or wall covering (deg.F-ft ² -hr/Btu).
$R_{\Gamma tot\gamma}$	- total thermal resistance of the roof (deg.F-ft ² -hr/Btu).
R-value	- thermal resistance of a material layer or set of layers (deg.F-ft ² -hr/Btu).
RBASE	- thermal resistance of basement walls (deg.F-ft ² -hr/Btu).
RPERIM	- thermal resistance of perimeter insulation (deg.F-ft ² -hr/Btu).
RROOF	- thermal resistance of the roof (deg.F-ft ² -hr/Btu).
RTAP	- thermal resistance of insulation layer in a thermosiphoning air panel (deg.F-ft ² -hr/Btu).
RWALL	- thermal resistance of the wall (deg.F-ft ² -hr/Btu).
s	- heat capacity scale factor (Btu/deg.F-ft ²).
S	- solar radiation absorbed per square foot of collector (Btu/ft ²).
$S_{\Gamma T\gamma}$	- total absorbed solar radiation (Btu).
SHF	- solar heating fraction for reference month.
$SHF_{\Gamma a\gamma}$	- annual solar heating fraction.
SLR	- monthly solar load ratio.
$SLR_{\Gamma m\gamma}$	- minimum monthly solar load ratio.
SLR*	- scaled solar load ratio.

T_{act}	- actual average indoor temperature (deg.F).
T_{ave}	- average thermostat setpoint (deg.F).
T_b	- base temperature (deg.F).
T_e	- effective thermostat setpoint (deg.F).
T_{set}	- thermostat setpoint (deg.F).
\bar{T}	- average room temperature with ventilation (deg.F).
\bar{T}_{max}	- average maximum room temperature without ventilation (deg.F).
TAP	- thermosiphoning air panels.
THICK	- thermal storage mass thickness (ft).
TLC	- total load coefficient (Btu/deg.F-day).
TLC_e	- effective total load coefficient (Btu/deg.F-day).
TLC_s	- steady state total load coefficient (Btu/deg.F-day).
TMY	- typical meteorological year.
U_C	- steady state conductance of the passive solar aperture (Btu/hr-ft ² -deg.F).
VTn	- solar radiation transmitted monthly through a vertical south facing aperture with n glazings (Btu/ft ² -month).
x	- dimensionless thickness.
X	- overhang length (ft).
Y	- separation (ft).

4. GENERAL REQUIREMENTS

4.1 Basic concepts. The concepts introduced herein are limited to those that are further developed within the remainder of the design procedures. Thus a comprehensive treatment is rejected in favor of one that is directed at areas of particular interest to the Navy in which our understanding is sufficient to warrant a quantitative treatment.

4.1.1 Direct gain heating. Direct gain buildings are passive solar heating systems in which sunlight is introduced directly to the living space through windows or other glazed apertures as indicated schematically in figure 1. As with all passive solar systems, it is important that the apertures face south or near south in order to achieve high solar gains during the winter heating season and low solar gains during the summer cooling season.

Thermal storage mass is essential to the performance and comfort of direct gain buildings. A building that has inadequate mass will overheat and require ventilation, which entails a loss of heat that might otherwise have been stored for night time use. Generally, it is desirable to employ structural mass as a storage medium in order to take advantage of the improved economics associated with multiple use. Insulation should always be placed on the outside of massive elements of the building shell rather than on the inside in order to reduce heat losses without isolating the mass from the living space. Concrete floor slabs can contribute to the heat capacity of a building provided they are not isolated by carpets and cushioning pads. Heat losses from the slab can be limited by placing perimeter insulation on the outside of the foundation walls. If the structure is fairly light, the heat capacity can be effectively increased by placing water containers in the interior. A variety of attractive containers are available commercially.

An overhang, also illustrated in figure 1, is used to shade the solar aperture from the high summer sun while permitting rays from the low winter sun to penetrate and warm the inside of the building. In climates having particularly warm and sunny summers, an overhang may not be sufficient to prevent significant aggravation of the summer cooling load. Sky diffuse and ground reflected radiation enter the living space despite the presence of an overhang and must be blocked by external covers or internal shades. Using movable insulation on direct gain apertures has the advantage of reducing night time heat losses during the winter-as well as eliminating unwanted solar gains during the summer.

Direct gain buildings involve less departure from conventional construction than other types of passive solar systems and are therefore cheaper and more readily accepted by most occupants. However, they are subject to overheating, glare, and fabric degradation if not carefully designed; these problems can be minimized by distributing the sunlight admitted to the building as uniformly as possible through appropriate window placement and the use of diffusive blinds or glazing materials. When properly designed for their location, direct gain buildings provide an effective means of reducing energy consumption for space heating without sacrifice of comfort or aesthetic values.

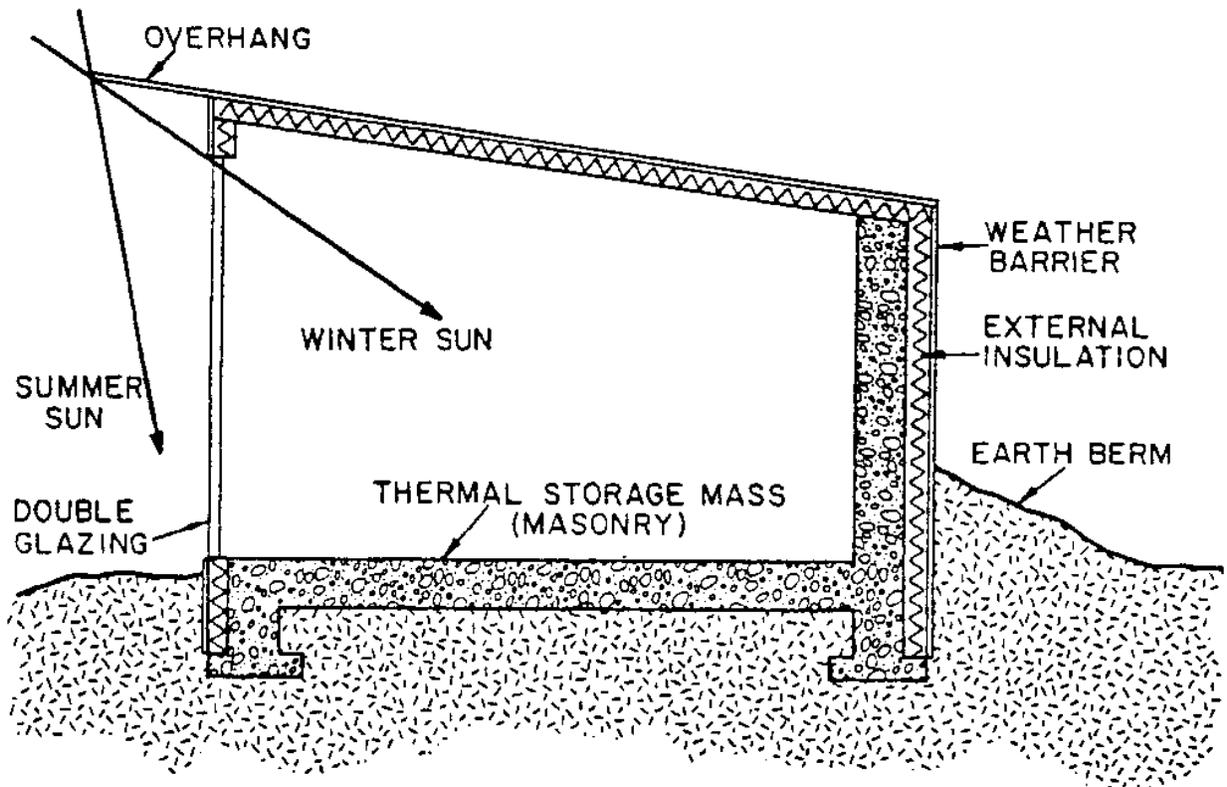


FIGURE 1. Direct gain heating system.

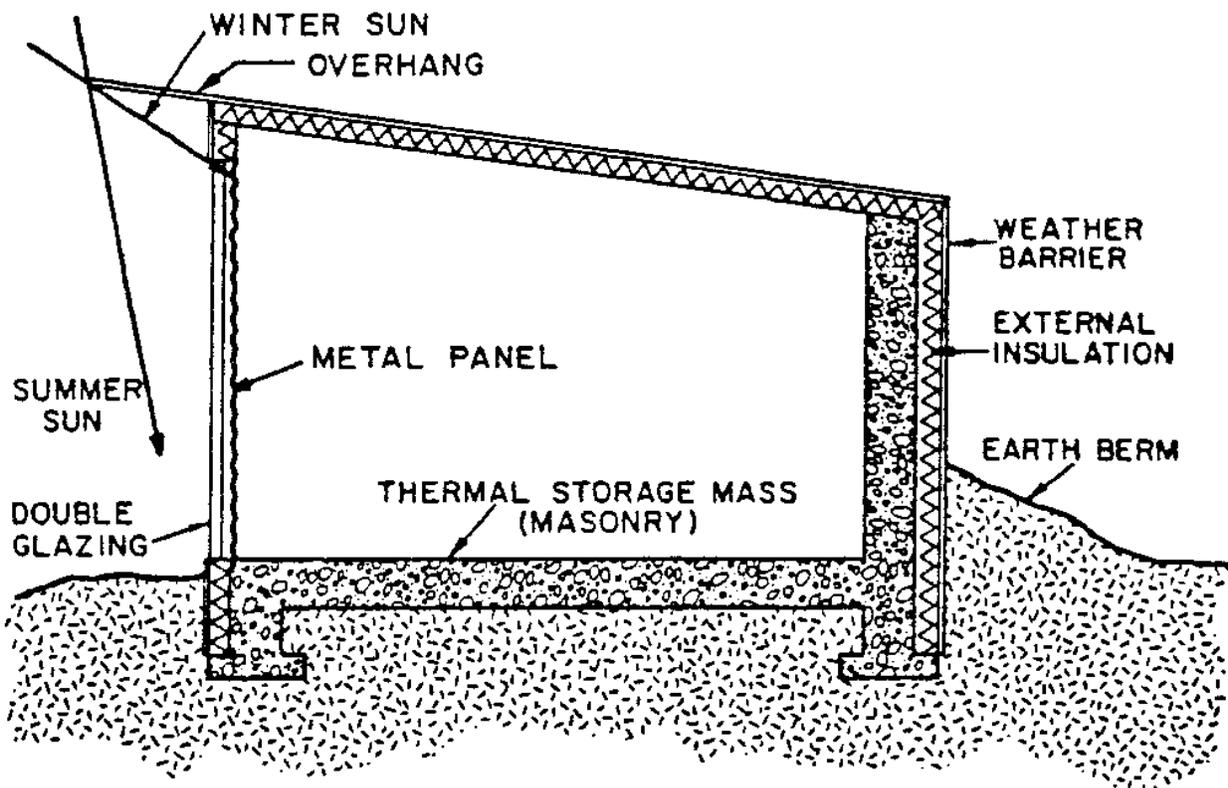


FIGURE 2. Radiant panel system.

4.1.2 Daylighting. The daylight delivered to the interior of direct gain buildings is an additional resource that is available year-round. Pleasing uniform illumination can be achieved by using blinds that reflect sunlight toward white diffusive ceilings. The artificial lighting system in many buildings imposes a significant load on the cooling system that may be reduced by daylighting because the fraction of visible light in the solar spectrum is greater than the visible fraction of incandescent or fluorescent lighting.

4.1.3 Radiant panels. Radiant panels are simple passive solar systems that are inexpensive and well suited as retrofits to metal buildings. A sketch of a radiant panel system is presented in figure 2. Note that the solar aperture consists of one or more layers of glazing material placed over an uninsulated metal panel. The metal panel would ordinarily be a part of the building shell so that a retrofit is constructed by simply glazing an appropriate area on the south side of the structure. Any insulation or other poorly conducting material should be removed from the inner surface of the glazed portion of the metal panel to facilitate heat transfer to the interior.

Solar radiation is absorbed on the outer surface of the metal panel after passing through the glazings. The panel becomes hot and gives up heat to the interior by radiation and convection. Thermal mass must be included inside the building shell as with direct gain systems. Usually, only a concrete slab will be available before retrofitting a metal building and it may sometimes be necessary to add water containers to achieve the desired thermal capacitance. Radiant panels perform on a par with direct gain buildings and are likely to be less expensive when used as retrofits to metal buildings.

4.1.4 Thermosiphoning air panels. Thermosiphoning air panels (TAPs) are also appropriate for use on metal buildings either as retrofits or in new construction. Two configurations occur in practice and the first, which is referred to as a frontflow system, is illustrated in figure 3. Again there are one or more glazing layers over an absorbing metal surface but, in this case, the metal panel is insulated on the back side. Heat transfer to the interior occurs via circulation vents cut through the metal panel and its insulation at the upper and lower extremes. Solar radiation absorbed on the the outer surface of the panel is converted to heat and convected to the adjacent air which then rises due to buoyancy forces and passes through the upper vent into the living space. The warm air leaving the gap between the inner glazings and the absorber is replaced by cooler air from the building interior that enters through the lower vents. In this manner, a buoyancy driven loop is established and sustained as long as the temperature in the air gap exceeds that in the living space. Passive backdraft dampers or manually operated vent closures must be employed to prevent reverse circulation at night. Backdraft dampers are usually made of a lightweight plastic material suspended above a metal grid such that air flows freely in one direction but is blocked should the flow attempt to reverse.

The second type of TAP configuration, illustrated in figure 4, is called a backflow system. In a backflow system, the flow channel is behind the absorber plate rather than in front of it. An insulated stud wall is constructed a few inches behind the metal panel and vents are then cut at the top and bottom of the wall. Air in the flow channel thus formed is heated by convection from the back of the absorber panel and a circulation loop is established in the same manner as in a frontflow system.

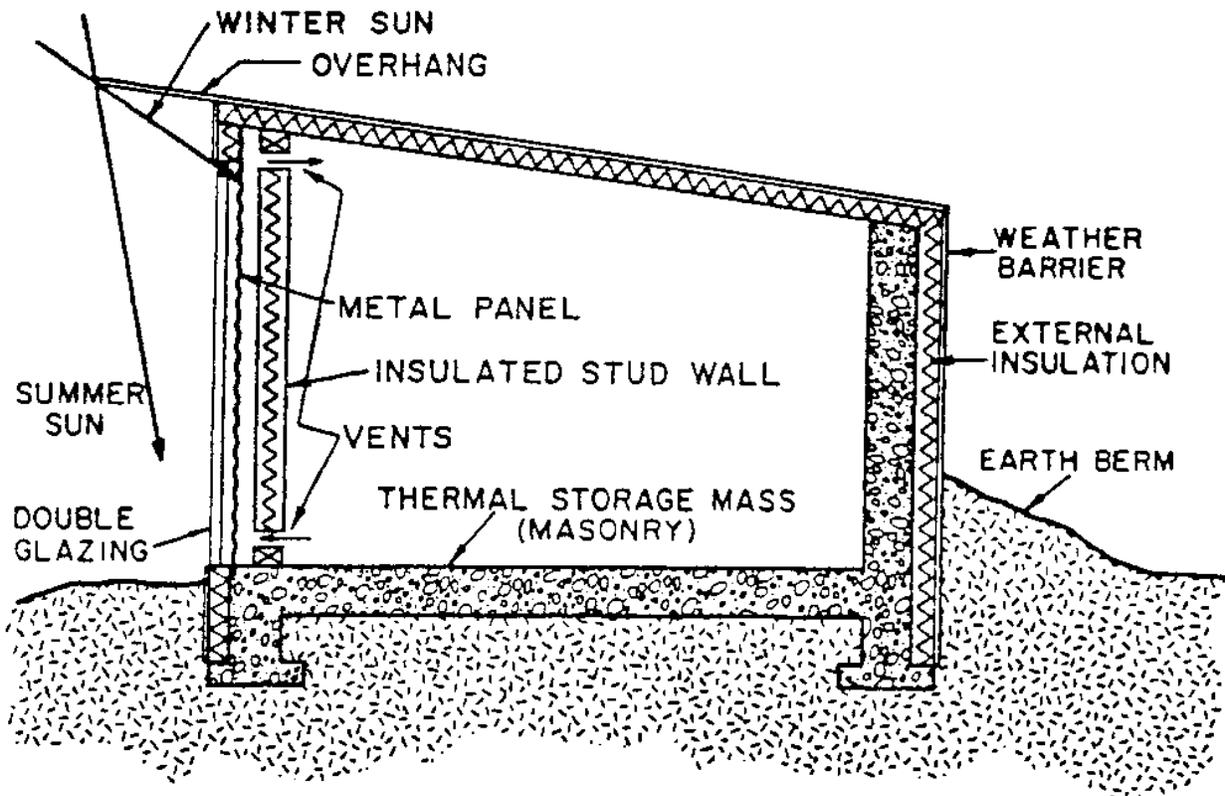


FIGURE 3. Frontflow TAP system.

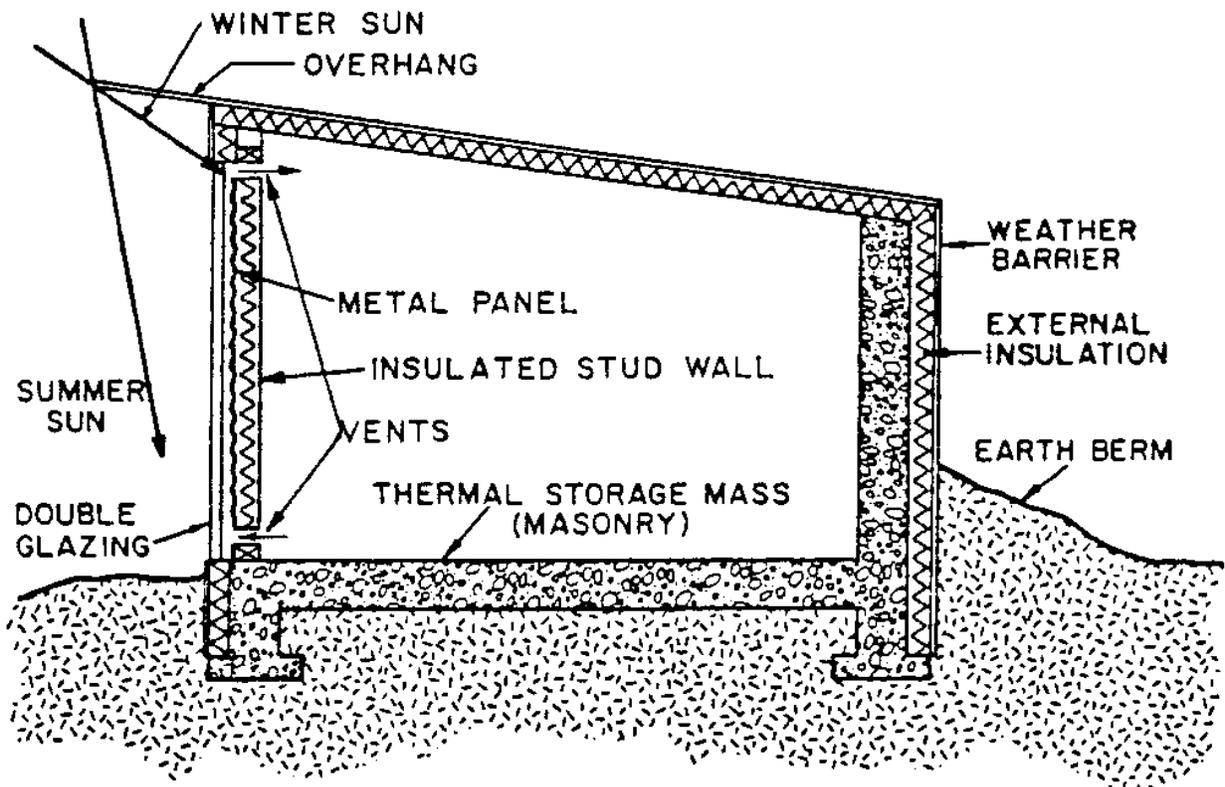


FIGURE 4. Backflow TAP system.

TAPs have thermal storage requirements similar to those of direct gain and radiant panel systems. Generally speaking, the best performance will be obtained from passive solar systems associated with high heat capacity structures. Although a backflow TAP performs slightly better than a comparable system in the frontflow configuration, the difference is not significant and construction costs should govern any choice between the two. Both TAP configurations outperform radiant panels and direct gain systems with comparable glazings and thermal storage mass. This performance edge is due to the low aperture conductance of TAPs, which can be insulated to arbitrary levels, thereby limiting night time heat loss.

4.1.5 Thermal storage walls. A thermal storage wall is a passive solar heating system in which the primary thermal storage medium is placed directly behind the glazings of the solar aperture, as illustrated in figure 5. The outer surface of the massive wall is painted a dark color or coated with a selective surface to promote absorption of solar radiation. Solar radiation absorbed on the outer surface of the wall is converted to heat and conducted (or convected in the case of the water walls) to the inner surface where it is radiated and convected to the living space. Heat transfer to the living space is sometimes augmented by the addition of circulation vents placed at the top and bottom of the mass wall. These vents function in the same manner as the vents in a TAP system except that only a portion of the solar heat delivered by the system passes through the vents.

A thermal storage wall provides an effective buffer between outside ambient conditions and the building interior; night time heat losses are reduced during the cold winter months, and during the summer, unwanted heat gains are limited. This moderating effect generally enables thermal storage walls to outperform direct gain systems. There are many types of thermal storage walls distinguished by the type of storage medium employed. The options included in the design procedures are reviewed in the following subsections.

4.1.5.1 Trombe wall. A Trombe wall is a thermal storage wall that employs solid, high density masonry as the primary thermal storage medium. Appropriate thicknesses range from 6 to 18 inches depending on the solar availability at the building site. Sunny climates require relatively thicker walls due to the increased thermal storage requirements. The wall may be vented or unvented. A vented wall is slightly more efficient and provides a quicker warm up in the morning but may overheat buildings containing little secondary thermal storage mass in the living space.

4.1.5.2 Concrete block wall. Ordinarily, a thermal storage wall would not be constructed of concrete building blocks, because solid masonry walls have a higher heat capacity and yield better performance. However, concrete block buildings are very common in the Navy and offer many excellent opportunities for passive solar retrofits. The south facing wall of a concrete block building can be converted to a thermal storage wall by simply painting the block a dark color and covering it with one or more layers of glazing. Walls receiving this treatment yield a net heat gain to the building that usually covers the retrofit costs rather quickly. The relatively low heat capacity of concrete block walls is offset somewhat by the large amount of secondary thermal storage mass usually available in these buildings. Concrete floor slabs and massive partitions between zones help prevent overheating and otherwise improve the performance of concrete block thermal storage walls.

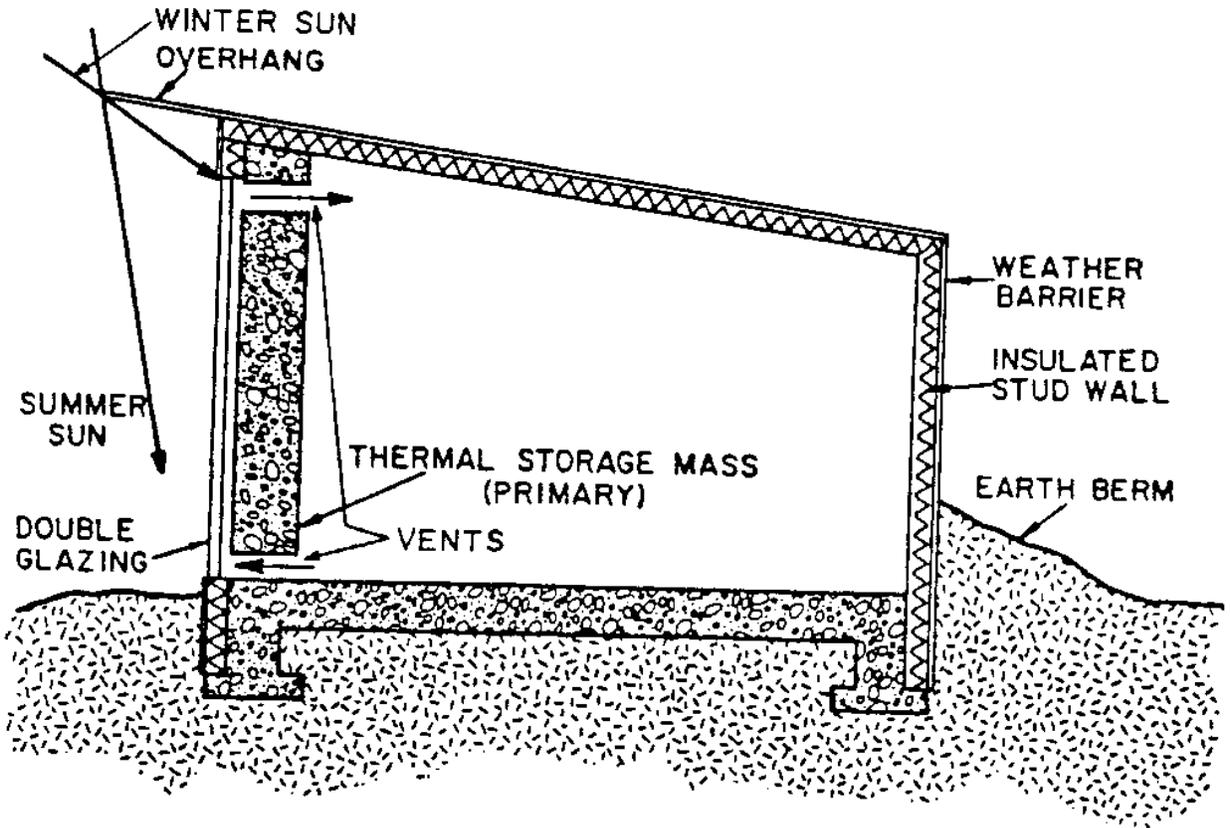


FIGURE 5. Thermal storage wall.

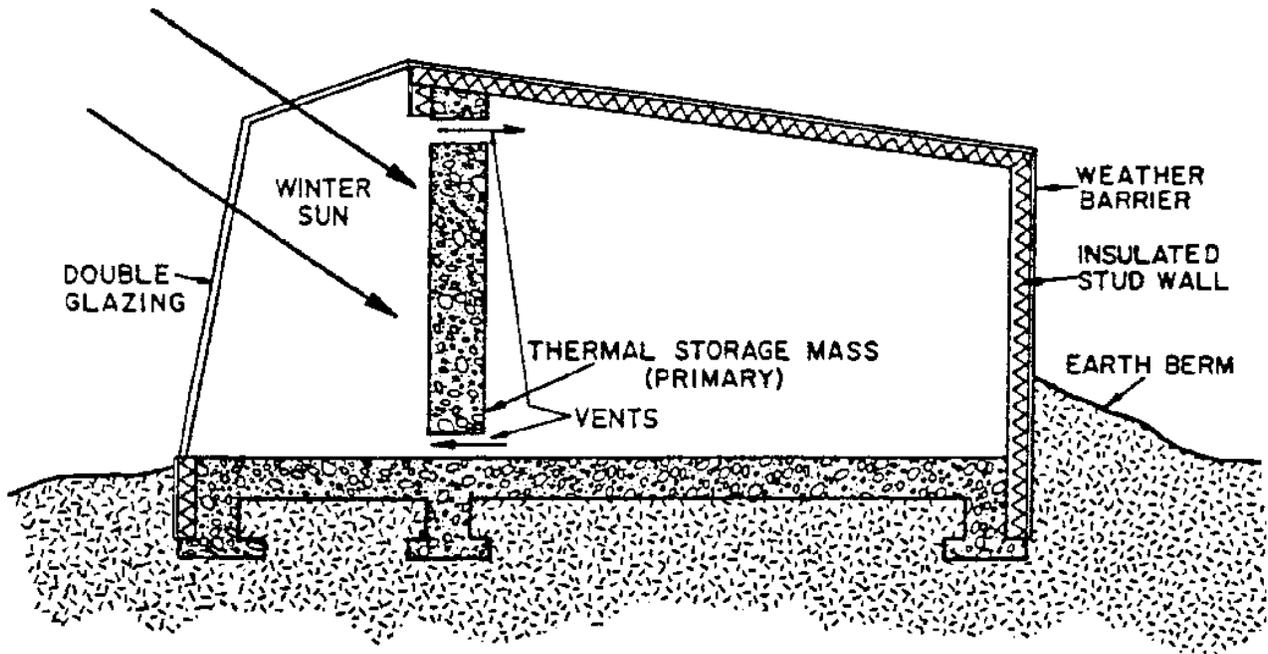


FIGURE 6. Sunspace.

Concrete block thermal storage walls may also be introduced during the construction of new buildings. For new construction, however, it is advisable to take advantage of the superior performance of solid masonry walls by filling the cores of the block in the thermal storage wall with mortar as it is erected. This process is inexpensive and the resulting performance increment covers the increased cost. The design procedures developed herein are applicable to 8-inch concrete block thermal storage walls with filled or unfilled cores.

4.1.5.3 Water wall. As the name implies, water walls are thermal storage walls that use containers of water placed directly behind the aperture glazings as the thermal storage medium. The advantage over masonry walls is that water has a volumetric heat capacity about twice that of high density concrete; it is therefore possible to achieve the same heat capacity available in a Trombe wall while using only half the space. Furthermore, a water wall can be effective at much higher heat capacities than a Trombe wall because natural convection within the container leads to an nearly isothermal condition that utilizes all of the water regardless of the wall thickness. The high thermal storage capacity of water walls makes them especially appropriate in climates that have a lot of sunshine.

4.1.6 Sunspaces. There are many possible configurations for a sunspace but all of them share certain basic characteristics; a representative schematic is presented in figure 6. Sunlight enters the sunspace through south facing glazing that may be vertical or inclined or a combination of the two and is absorbed primarily on mass surfaces within the enclosure; the mass may be masonry or water in appropriate containers and is generally located along the north wall and in the floor. The massive elements provide thermal storage that moderates the temperature in the enclosure and the rate of heat delivery to the living space located behind the north wall. Operable windows and circulation vents in the north wall provide for heat transfer by thermal convection from the sunspace to the living space. The north wall may be an insulated stud wall placed behind containers of water or a masonry wall through which some of the heat in the sunspace is delivered to the building interior by thermal conduction as occurs in a Trombe wall. A sunspace may be semi-enclosed by the main structure such that only the south facing aperture is exposed to ambient air, or may be simply attached to the main structure along the north wall of the sunroom, leaving the end walls exposed.

The temperature in a sunspace is not thermostatically controlled but is generally moderate enough for human habitation during most of the day and appropriate for growing plants year round. Amenities are thus provided that compensate for the somewhat higher cost of sunspaces relative to other types of passive solar heating systems.

4.1.7 Incremental cooling load. Unfortunately, not all of the heat delivered to the living space by a passive solar heating system is useful to the occupants. During the winter heating season, part of the delivered solar energy will cause the building to overheat unless ventilation is employed to limit the indoor temperature. It is to be expected that some overheating will occur in most passive solar buildings, but too much excess heat is indicative of a poor design: it may be that the solar aperture is too large or that inadequate thermal storage mass has been provided. During the summer cooling

season, a passive solar heating system continues to function although the increased solar elevation angle reduces the radiation flux transmitted through the glazings, particularly if an overhang is employed. However, all heat delivered to the building during the cooling season is unwanted and must be removed either by ventilation or by evaporative or vapor compression cooling systems. A poorly designed passive heating system can significantly aggravate the summer cooling load of a building.

In the design procedures, the sum of all unwanted heat delivered to a building by the passive heating system will be referred to as the incremental cooling load. This is clearly an important parameter because it represents the cooling penalty associated with various passive solar designs.

4.2 General climatic considerations.

4.2.1 Characteristic weather parameters. All of the discussion in this section is based on two weather parameters that, in certain combinations, may be used to characterize climates with respect to the potential effectiveness of conservation and passive solar measures in reducing energy consumption for space heating.

The first of these important parameters is the heating degree days, which is represented by the symbol DD and has units of deg.F-day. In these procedures, DD is calculated by summing the difference between the base temperature and the outside ambient temperature over each hour in the time period of interest and dividing the result by 24 hr/day; all negative terms are omitted from the sum. The base temperature is the thermostat setpoint adjusted to account for the presence of internal heat sources; the time period of interest is usually one month or one year. This method of calculating DD differs from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) approach and was selected because it yields better accuracy when applied to the analysis of passive solar buildings. Furthermore, the hourly data required for such a calculation is available in the Typical Meteorological Year (TMY) data base that is used consistently throughout these procedures (from Input Data for Solar Systems and Generation of Typical Meteorological Years for 26 SOLMET Stations). The heating degree days is an important weather parameter because the amount of heat lost from a building during a particular time period is directly proportional to DD, i.e., if a building is moved from one location to another having twice as many degree days, the heat loss from the building will double.

The second important weather parameter is VT₂, the amount of solar energy transmitted through a vertical, south facing, double glazed aperture during a specific time period. The V in VT₂ stands for vertical, the T indicates transmitted radiation, and the 2 represents the two glazing layers. The parameter VT₂ is important because it quantifies the solar resource available for passive space heating.

In the following sections, combinations of VT₂ and DD will be used to characterize climates with regard to the relative importance of conservation and passive solar measures for reducing auxiliary heat consumption in buildings.

4.2.2 Importance of conservation measures. The fraction of the monthly heating load of a building that can be met by passive solar strategies depends on certain characteristics of the building design, and for double glazed systems, which are by far the most common, on the ratio VT2/DD; the details of the relationship between the solar heating fraction (SHF) and VT2/DD will be addressed later in 4.4 and 5.1. For the present, it is sufficient to know that the parameter VT2/DD provides an accurate measure of the passive solar potential of a given climate during any selected month. It follows that by considering the value of VT2/DD for each month in the heating season, it is possible to assess the passive solar potential of the climate-for the full annual cycle. One way to do this might be to average VT2/DD over all months in the heating season, but that approach would ignore the fact that it is more important to have high solar heating fractions in cold months with high values of DD than it is in warm months with low values of DD. The solution to this dilemma is to determine the degree day weighted average of VT2/DD as follows:

$$(\text{VT2/DD})_{\text{ave}} = \frac{N}{\text{[SIGMA]}} \left[\sum_{m=1}^N (\text{VT2/DD})_{\text{m}} \left[\text{multiplied by} \right] \left(\text{DD}_{\text{m}} / \text{DD}_{\text{a}} \right) \right]$$

where the index, m , is the month number, N is the number of months in the heating season, and DD_{a} is the annual heating degree days. The quantity $(\text{VT2/DD})_{\text{ave}}$ provides the desired measure of the annual passive solar potential of various climates. High values of $(\text{VT2/DD})_{\text{ave}}$ are associated with high values of SHF and conversely. It follows that in climates having low values of $(\text{VT2/DD})_{\text{ave}}$, conservation measures such as insulation, storm windows, weather stripping, etc., will be more important than in climates having high values. If only a small portion of the building load can be displaced with solar energy, then reduction of that load through the use of conservation measures clearly becomes a top priority.

A map of the continental United States with contours of constant $(\text{VT2/DD})_{\text{ave}}$ is presented in figure 7. The values of $(\text{VT2/DD})_{\text{ave}}$ on the uppermost, middle, and lowest contours are 30, 50, and 90 Btu/deg.F-ft²-day, respectively. The three contour lines divide the map into four climate regions that are referred to as mild (MI), moderate (MO), harsh (HA), and very harsh (VH). General descriptions of these climate regions and qualitative comments regarding regionally appropriate design are presented in the next four subsections.

4.2.2.1 Mild climates. The mild climate region includes the southern third of California and Arizona, small parts of the southern extremes of New Mexico, Texas, and Louisiana, and most of the Florida peninsula.

In the mild region the winter heating load varies from small to nil and in any case, there is plenty of sunshine available to meet whatever loads do arise. Generally, the small heat loads can be displaced with inexpensive radiant panels or direct gain systems having relatively small solar collection apertures. However, summer cooling loads in this region can be quite high, usually exceeding the winter heating load several times over. It is therefore particularly important to assure that the incremental cooling load associated with the passive heating system does not negate the small savings realized during the winter heating season. The use of defensive countermeasures such

PRINCIPAL CLIMATE REGIONS

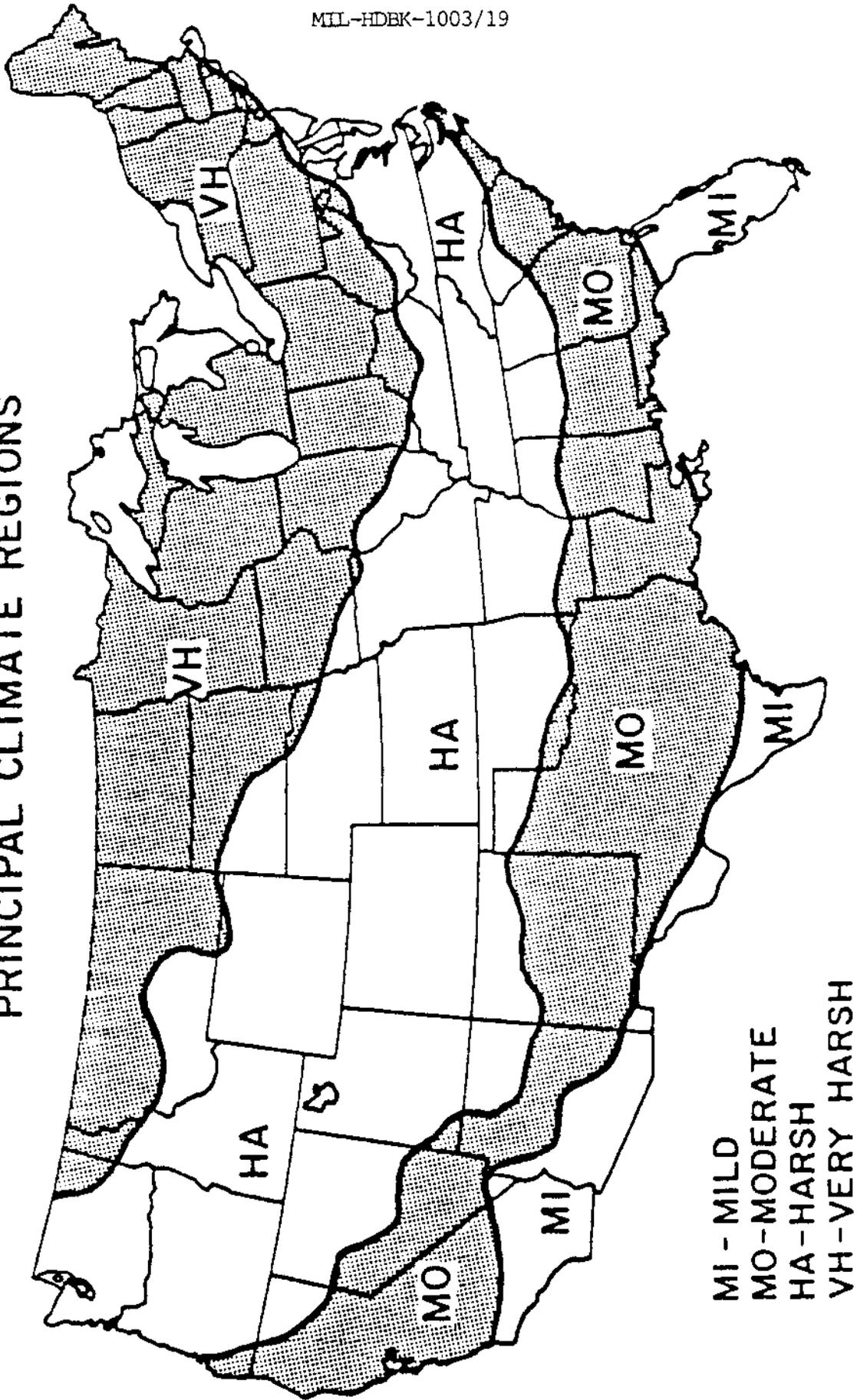


FIGURE 7. Principal climate regions.

as adjustable shades and shutters that shield the solar aperture from direct and diffuse sunlight during the cooling season is essential. The term defensive cooling refers to strategies or devices that prevent excess heat from entering a building, in contrast to procedures for removing such heat with air conditioning equipment after it has gained entry. Because of the high SHFs obtainable in the mild region, conservation measures are not as important as in regions further north.

4.2.2.2 Moderate climates. The moderate region includes most of California, the southern half of Nevada, the central third of Arizona, and most of New Mexico, Texas, Louisiana, Mississippi, Alabama, Georgia, and South Carolina. The Florida panhandle and most of the North Carolina coast are also included.

Thermal storage walls, sunspaces, thermosiphoning air panels, and direct gain systems are all appropriate in this region. The solar apertures will be larger than in the mild region and more thermal insulation will be required. Defensive cooling strategies are also important to overall performance.

4.2.2.3 Harsh climates. The harsh region includes most of Washington, Oregon, Idaho, Nevada, Wyoming, Utah, Colorado, Nebraska, Kansas, Oklahoma, Missouri, Arkansas, Kentucky, Tennessee, Virginia, and North Carolina. Northern parts of Arizona, New Mexico, Texas, Mississippi, Alabama, Georgia, and South Carolina are also included as well as southern parts of Montana, South Dakota, Iowa, Illinois, Indiana, and West Virginia. Finally, the harsh region includes coastal areas in Massachusetts, Rhode Island, New York, New Jersey, Maryland, and all of Delaware.

At the northern extremes of the harsh region, night insulation should be considered on direct gain apertures. Otherwise, all passive systems discussed in 4.1 may be adequate in this region; heating loads are substantial making conservation measures very important. Despite the large heating loads, defensive cooling strategies are still required to assure positive net energy savings.

4.2.2.4 Very harsh climates. The very harsh region includes all of North Dakota, Minnesota, Wisconsin, Michigan, Ohio, Vermont, New Hampshire, and Maine; most of Montana, South Dakota, Iowa, Illinois, Indiana, West Virginia, Connecticut, Pennsylvania, and Massachusetts; and parts of Washington, Idaho, Wyoming, Nebraska, Kentucky, Virginia, Maryland, New Jersey, and Rhode Island.

Near the boundary between the harsh and very harsh regions or in areas with greater than average sunshine, direct gain systems without night insulation may still be viable provided the aperture is kept fairly small. Thermal storage walls and sunspaces will function well in this region although night insulation may be desirable near the northern boundary; TAPs are a good choice because arbitrarily high levels of fixed insulation can be placed between the collector surface and the living space. Heavy use of conservation measures is critical to performance in the very harsh region. Defensive cooling strategies, though less of a concern than in regions with milder winter climates, should not be ignored.

4.2.3 Solar availability. As previously discussed, the parameter VT2 provides a measure of the availability of solar radiation as a space heating resource during a specified time period. If VT2 were evaluated for the duration of the winter heating season the result would provide some indication of the potential of the site for passive solar heating applications. However, it is more important to have high solar availability during the colder months of the heating season than during the warmer months, and the straight summation involved in evaluation of VT2 does not reflect this fact. A better measure of the effective solar availability is obtained by taking the degree day weighted average of the monthly VT2s that occur during the heating season as follows:

$$VT2_{\text{ave}} = \frac{N}{m=1} [\text{SIGMA}] [VT2 \text{ [multiplied by] } (DD_{\text{m}}/DD_{\text{a}})] \quad (\text{Equation 4.1})$$

A map of the continental United States with contours of constant $VT2_{\text{ave}}$ is presented in figure 8. The contours are defined by $VT2_{\text{ave}}$ values of 30, 25, 20, and 15. The four contours divide the map into five regions that are labeled most sunny (MS), very sunny (VS), sunny (SU), cloudy (CL), and very cloudy (VC). These five regions cut across the four principal climate regions defined in figure 7 and form subregions that are related to the appropriate size of solar apertures. As a general rule, the sunnier subregions of a particular principal climate region should have the larger solar apertures.

The ideal climate for passive solar applications is one in which high solar availability coincides with a large heat load; large apertures are appropriate in such a climate. In the continental United States, the best climates for passive solar design lie in the subregion formed by the most sunny and harsh climate regions. Solar apertures should be relatively small in the mild climate region because the heat load is small, and relatively small in the very harsh region because solar availability is low. Some general comments on the solar regions defined in figure 8 are presented below.

4.2.3.1 Most sunny region. This region is limited to the desert southwest and includes major parts of Nevada, Arizona, and New Mexico. Subregions in which the most sunny region overlaps the harsh region are ideal for passive solar heating because of the coincidence of a substantial heating load and excellent solar availability. The most sunny/moderate subregion is also quite good for passive solar heating.

4.2.3.2 Very sunny region. The very sunny region forms a complex crescent that bounds the most sunny region. It forms a large, very sunny/harsh subregion in which passive solar applications are very beneficial.

4.2.3.3 Sunny region. The sunny region forms a still larger crescent about the very sunny region, and includes parts of Florida, Alabama, Georgia, South Carolina, North Carolina, and Virginia. The sunny area cuts completely across the country from North to South and forms subregions with all four principal climate zones. A broad range of passive solar designs is viable across these subregions.

4.2.3.4 Clouds region. The cloudy region also traverses the country from north to south and forms four types of subregions among which many passive designs are feasible. Parts of the Pacific northwest, the Midwest, and the eastern seaboard are included in the cloudy region.

SOLAR AVAILABILITY REGIONS

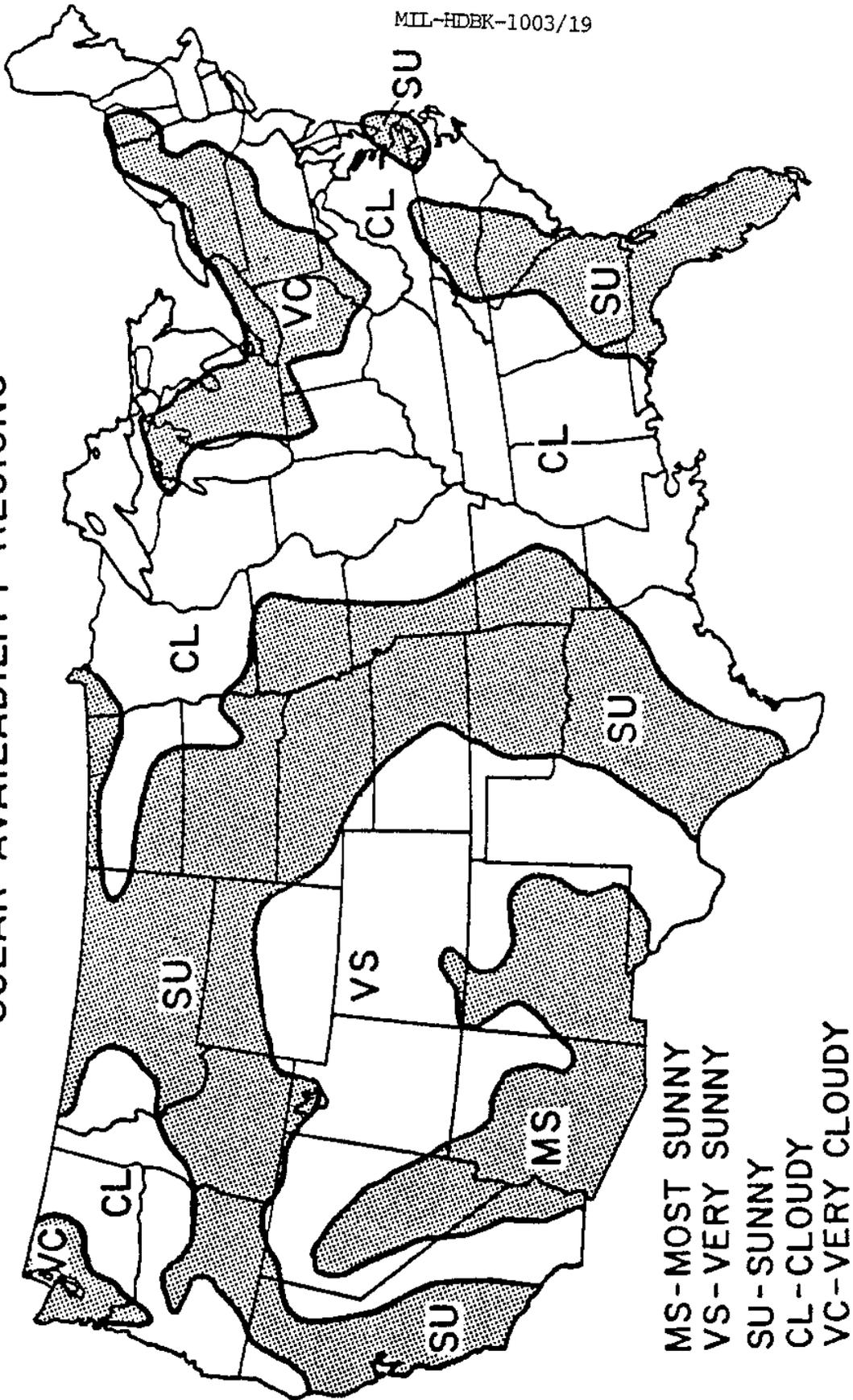


FIGURE 8. Solar availability regions.

4.2.3.5 Very cloudy region. The very cloudy region includes only the extreme Pacific Northwest and the central to eastern Great Lakes area. The Great Lakes area, where the very cloudy region overlaps the very harsh region, is the poorest location in the continental United States for passive solar heating. The Pacific northwest area overlaps the Harsh climate region and is slightly better suited for passive solar applications.

Schematic design guidelines that are related to the climate regions appearing in figures 7 and 8 are presented in 4.3.

4.3 Guidelines for schematic design. The objective during schematic design is to develop a rough idea of what the final building will be like. The designer is not concerned with detail at this point but seeks only to establish the basic shape, dimensions, materials, window areas, and insulation levels that will characterize the design; in these procedures, the characteristics of the passive solar heating system are added to the list of more traditional architectural concerns.

The guidelines in this chapter provide starting point values for the basic passive solar design parameters; if the user already has a good idea what his building will be like he may skip to 4.4 where the fundamentals of design analysis are introduced.

4.3.1 Building shape and orientation. Passive solar buildings are usually elongated in the east-west direction so that a large south-facing surface is presented to the low winter sun for solar heating, and small east and west-facing surfaces are presented to the northerly rising and setting summer sun to reduce unwanted solar gains. The aspect ratio (east-west dimension divided by north-south dimension) should be at least 5/3, and much larger values are appropriate for large dormitory-like structures.

Ideally, passive solar buildings should be no more than two zones deep in the north-south direction. The two zone limit on depth generally allows solar heat collected on the south side of the building to be transported for use to the north side, thereby improving thermal performance. Multi-story buildings are well suited to passive solar design, particularly if the above recommendations on aspect ratio and depth are observed, because of the large vertical surface that may be presented to the winter sun for solar absorption.

Orientations that depart from true south by up to 30 degrees are permissible; performance penalties will usually be less than 10 percent. An easterly bias is preferred in applications that require a rapid warm up in the morning, whereas a westerly bias will sometimes improve the performance of buildings that are occupied in the evening because of the improved phasing of heat source and heat load.

4.3.2 East, west, and north windows. Windows not facing south should be kept small while complying with local building codes. Particularly in the colder climates, it is best to place most of the nonsouth window area on the east or west side of the building to take advantage of winter solar gains available during the early morning and late afternoon.

All windows, including those facing south, should have at least two glazing layers, and in the harsh and very harsh regions, triple or even quadruple glazing should be considered. Especially in the warmer climates, drapes or better still, movable opaque covers or shades, as described in Thermal Shutters and Shades, are recommended as means to prevent unwanted sunlight from entering the windows during the summer.

4.3.3 Passive heating system characteristics. The interaction between a passive heating system and its environment is a complex process that involves many subtle phenomena. The complexity of the interaction makes it difficult to determine exactly what type of passive system will perform best in a given climate. Ultimately, detailed design analysis calculations of the type to be described later in these procedures may be required to make the final decision. However, a few generalizations may be cited that are useful for selecting candidate systems during the schematic phase of design.

The general rules for system selection are based on the steady state conductance ($U_{\Gamma C_1}$) of the passive solar aperture. The aperture conductance is the amount of heat that would be lost through the solar aperture if the outside ambient temperature were maintained at 1deg.F below the indoor temperature for a period of one hour; the units of $U_{\Gamma C_1}$ are Btu/deg.F-ft²-hr. It is generally true that systems with low values of $U_{\Gamma C_1}$ are better suited for use in areas having relatively severe winter climates than are systems with larger aperture conductances. The climate regions based on the importance of conservation measures that are illustrated in figure 7 provide a convenient measure of winter severity. The selection process based on aperture conductance may be further refined by the observation that it is also more important to have a small $U_{\Gamma C_1}$ in regions that receive relatively little sun; the solar availability contour map in figure 8 is useful in making this secondary assessment. In summary, passive solar systems having low aperture conductances are recommended for use in regions having severe winter climates with little sunshine. The steady state aperture conductances of thirteen representative passive solar heating systems is presented in table I to aid in the preliminary selection process.

The first system in table I, a single glazed direct gain building, is not recommended in any climate region because of the large aperture conductance; even in a mild winter climate where the heating load may not be a problem, the summer cooling load can be seriously aggravated by single glazed apertures. Systems 2 through 5, or any other system with comparable values of $U_{\Gamma C_1}$, are well suited for use in the mild climate region. In the moderate region, systems 2 through 9 are appropriate, and in the harsh region systems 4 through 14 may be considered. Finally, in the very harsh region, systems 9 through 14 will yield the best results. Within each of the principal climate regions, the recommended systems having the larger conductances are more appropriate in the sunnier subregions. These guidelines may be useful during the initial system selection process, but the designer should feel free to also consider other systems. In particular, a small amount of direct gain is almost always an asset when combined with other systems having lower aperture conductances. Of course, in the colder regions, it is desirable to place more layers of glazing in the direct gain apertures than would be used in milder climates.

TABLE I. Steady state aperture conductances of passive systems.

System Number	System Type	$U_{\Gamma C_1}$ (Btu/hr-ft ² -deg.F)
1	Single glazed direct gain.	1.10
2	Double glazed direct gain.	0.49
3	Single glazed radiant panel.	0.49
4	Double glazed radiant panel.	0.31
5	Triple glazed direct gain.	0.31
6	Double glazed direct gain with R-9 night insulation.	0.27
7	Double glazed 12-inch Trombe wall.	0.24
8	Double glazed attached sunspace with 40 degree tilt from vertical, masonry common wall, and opaque end walls.	0.23
9	Double glazed 12 inch Trombe wall with R-9 night insulation.	0.15
10	Single glazed front flow TAP with R-11 insulated wall.	0.073
11	Double glazed front flow TAP with R-11 insulated wall.	0.068
12	Double glazed backflow TAP with R-11 insulated wall.	0.064
13	Double glazed attached sunspace with 40 tilt from vertical, R-20 insulated common wall, and opaque end walls.	0.043
14	Double glazed backflow TAP with R-20 insulated wall.	0.041

A more complete list of aperture conductances is available in Appendix A; those appearing in table I provide a representative sample that spans the full range of realistic possibilities and is adequate for the present discussion.

4.3.4 Sizing overhangs. The purpose of a fixed overhang is to reduce unwanted solar gains during the summer while allowing the low winter sun to illuminate the solar aperture and provide heat to the building interior. Sizing an overhang is a difficult problem because the heating season is not symmetrical about the winter solstice, but tends to be displaced toward the new year. Therefore, a design that provides adequate protection from overheating in the fall may tend to reduce the amount of solar energy available for needed space heating in late winter or spring. Since an overhang does not provide protection from sky diffuse or ground reflected radiation, it is often necessary to provide additional countermeasures to prevent overheating during the cooling season. For this reason, the currently accepted design practice is to size an overhang such that the performance of the passive heating system is minimally affected, and employ additional countermeasures against overheating as required. The sizing procedure introduced below is based on "How to Design Fixed Overhangs", by Andrew Lau.

The contour map presented in figure 9 gives the last month for which full illumination of a solar aperture facing within 20 degrees of true south is desired. This map is one of several presented by Lau and represents a direct gain building with an aperture size of 15 percent to 25 percent of the floor area on a moderately well insulated house (R-19 to R-30 roof, R-11 to R-19 wall, 0.5 to 0.75 air changes per hour). Use of the map in figure 9 will yield conservatively sized fixed overhangs in that there should be no degradation of passive solar performance during the heating season although there may be some tendency toward overheating in the fall. Movable shading devices should be employed to control overheating due to asymmetry of the heating season.

After determining the last month for which total illumination of the aperture will be allowed, it is an easy matter to fix the overhang geometry. The overhang length is denoted by X and the separation is given by Y, as indicated in figure 10. The ratio X/Y is related to the latitude (L) minus the declination (D) and this relationship is represented graphically in figure 11. The quantity (L-D) may be read from one of the four contour maps in figure 12 that represent the months of January, February, March, and April. Briefly summarizing the sizing procedure, the user first determines the last month of total illumination from the contour map in figure 9; then he reads (L-D) from the contour map for that month from figure 12; finally, the length to separation ratio is obtained from the plot in figure 11.

Summer shading is enhanced by selecting the largest practical overhang separation and then calculating the length from the ratio X/Y. Constraints on building geometry will generally limit the overhang separation.

4.3.5 Insulation levels. Starting point values for thermal insulation are recommended on the basis of principal climate region and building size, and geometry. The R-values (thermal resistance in deg.F-ft²-hr/Btu) of walls, including installed insulation and other layers, should lie in the intervals indicated in figure 13 for small (1500 ft²), one story, single family detached residences. The values suggested in figure 13 are consistent with the results of a study presented in DOE/CS-0127/3, Passive Solar Design Handbook, Volume Three, on the economics of mixing conservation and passive solar strategies that was conducted for the United States Department of Energy.

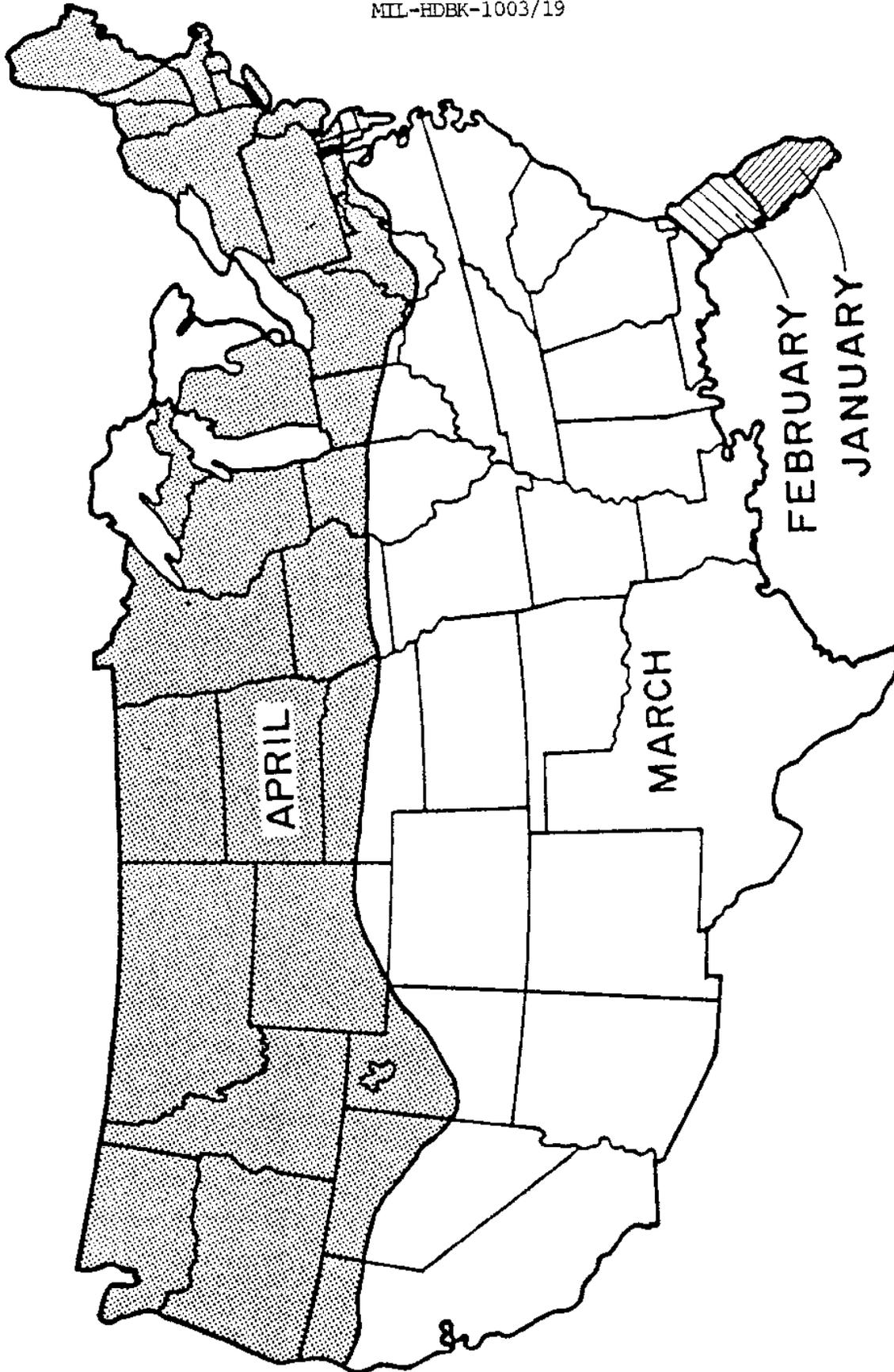
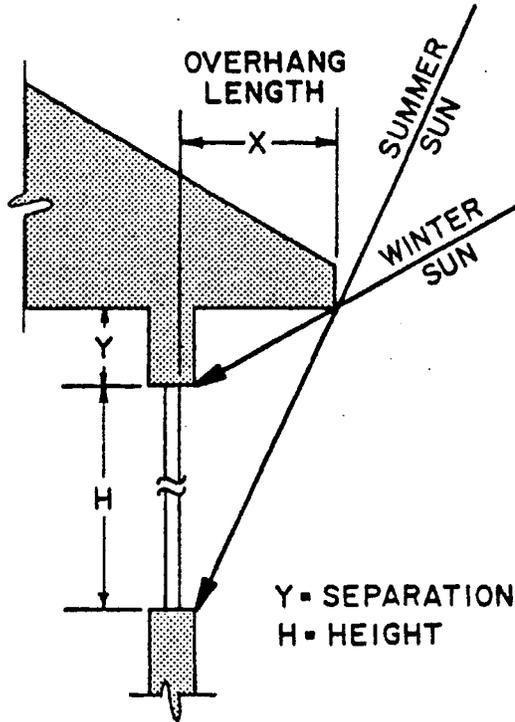


FIGURE 9. Last month for full illumination of solar aperture facing within 20 degrees of true south.



SEPARATION RATIO = Y/H
OVERHANG RATIO = X/H

FIGURE 10. Overhanging geometry

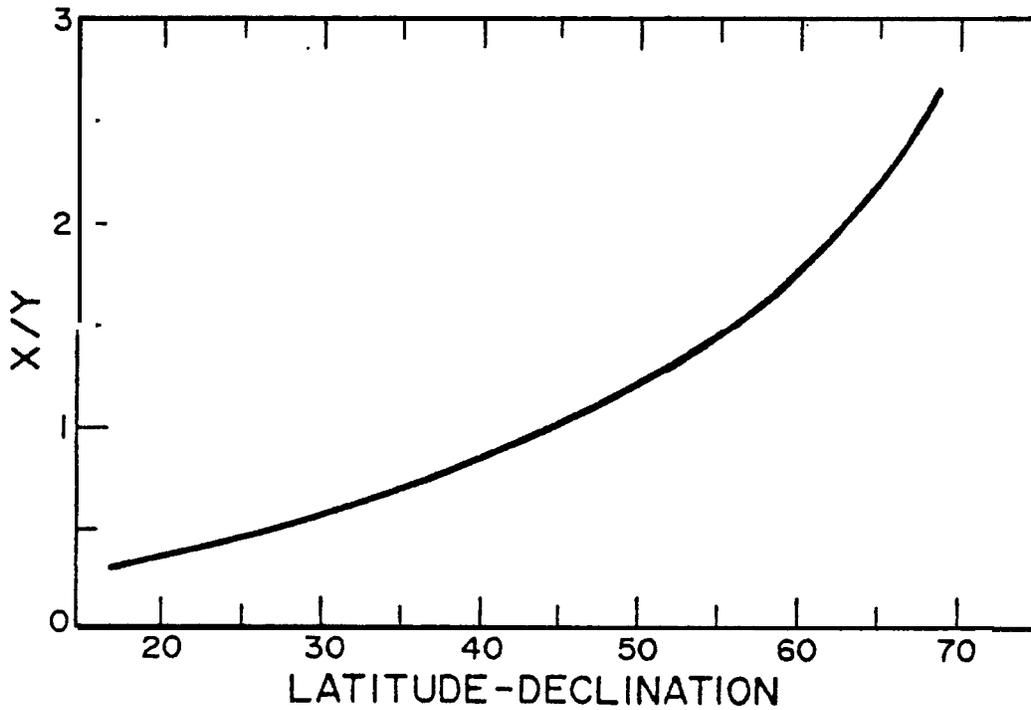


FIGURE 11. Ratio X/Y related to (Latitude - declination)

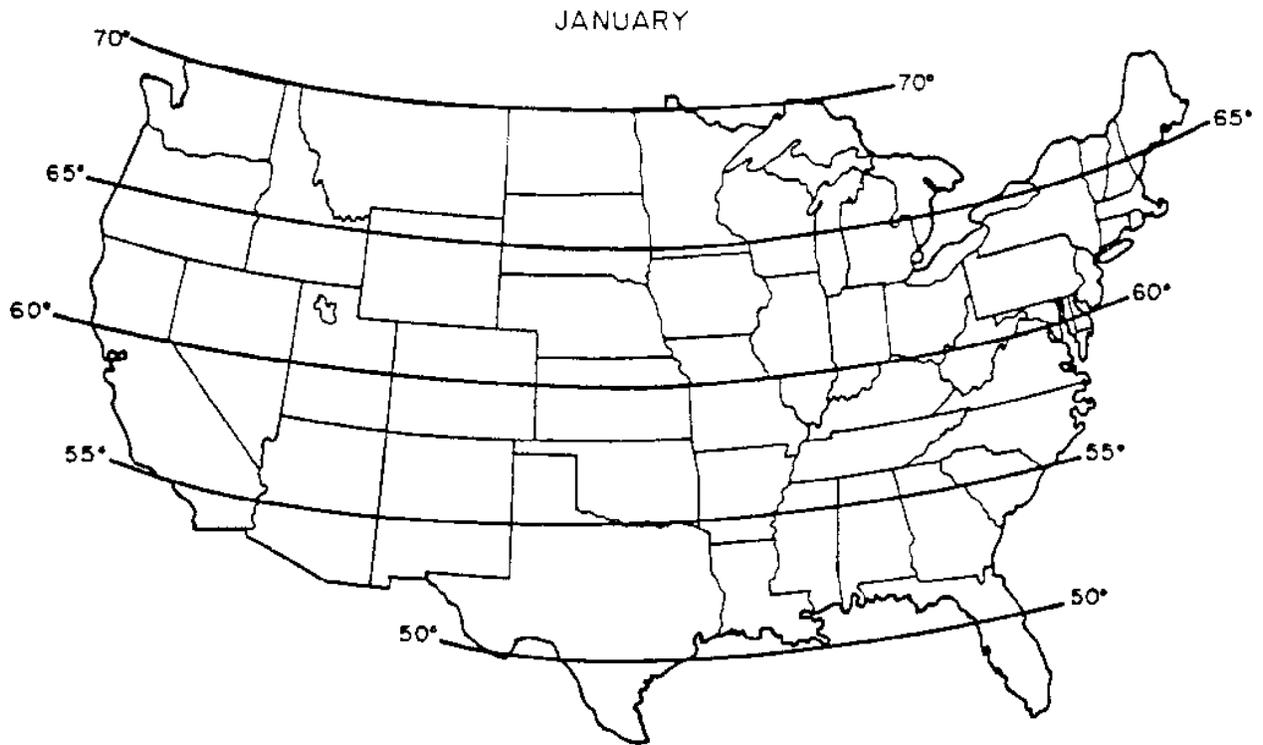


FIGURE 12(a). (Latitude - Declination) for January.

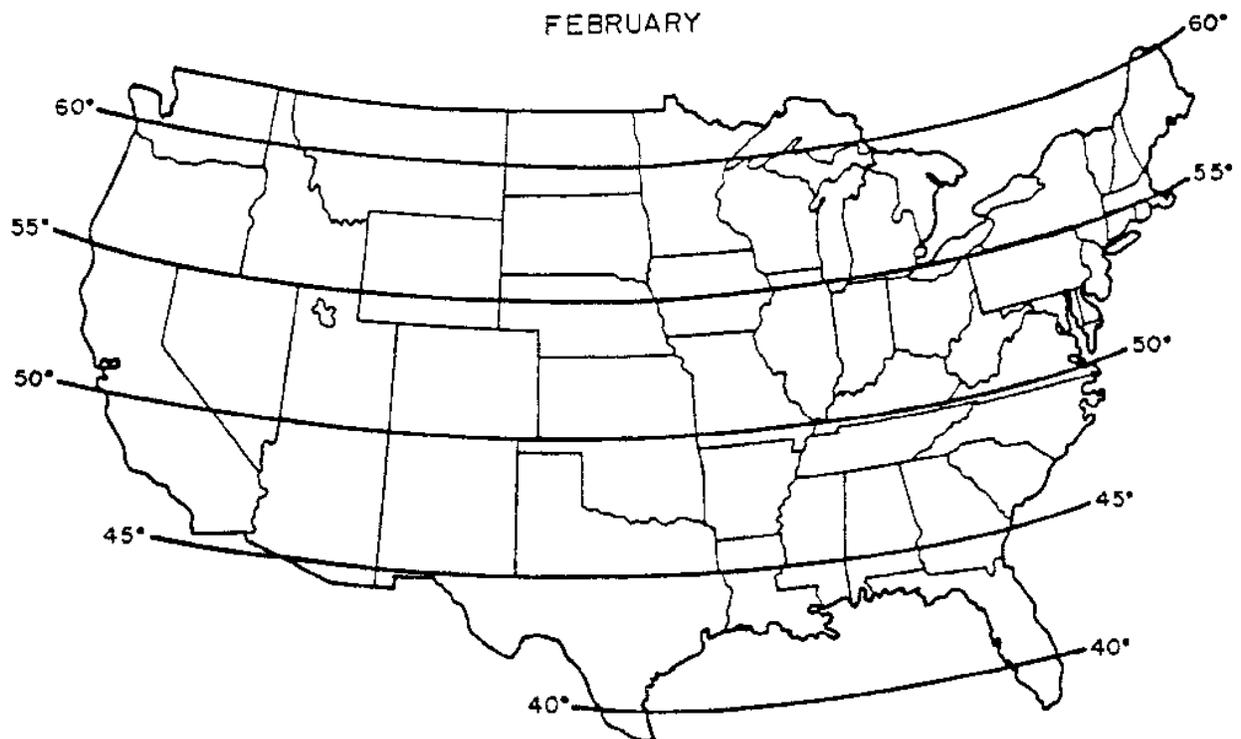


FIGURE 12(b). (Latitude - Declination) for February.

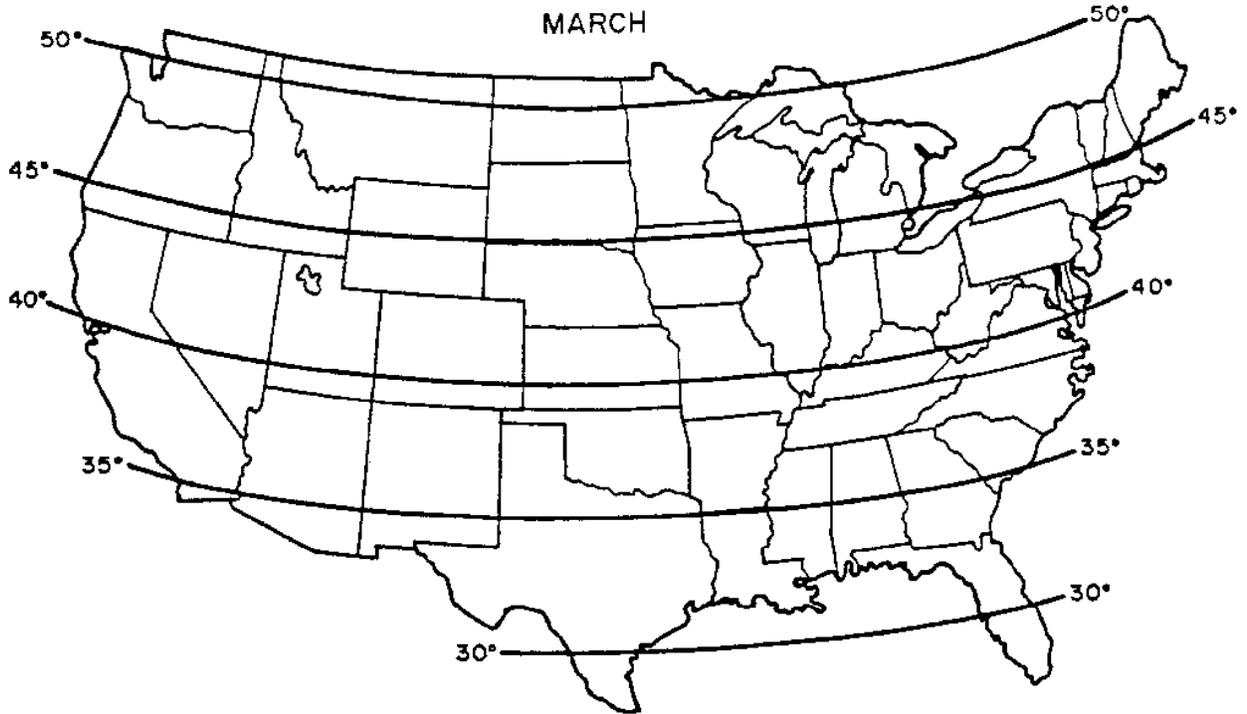


FIGURE 12(c). (Latitude - Declination) for March.

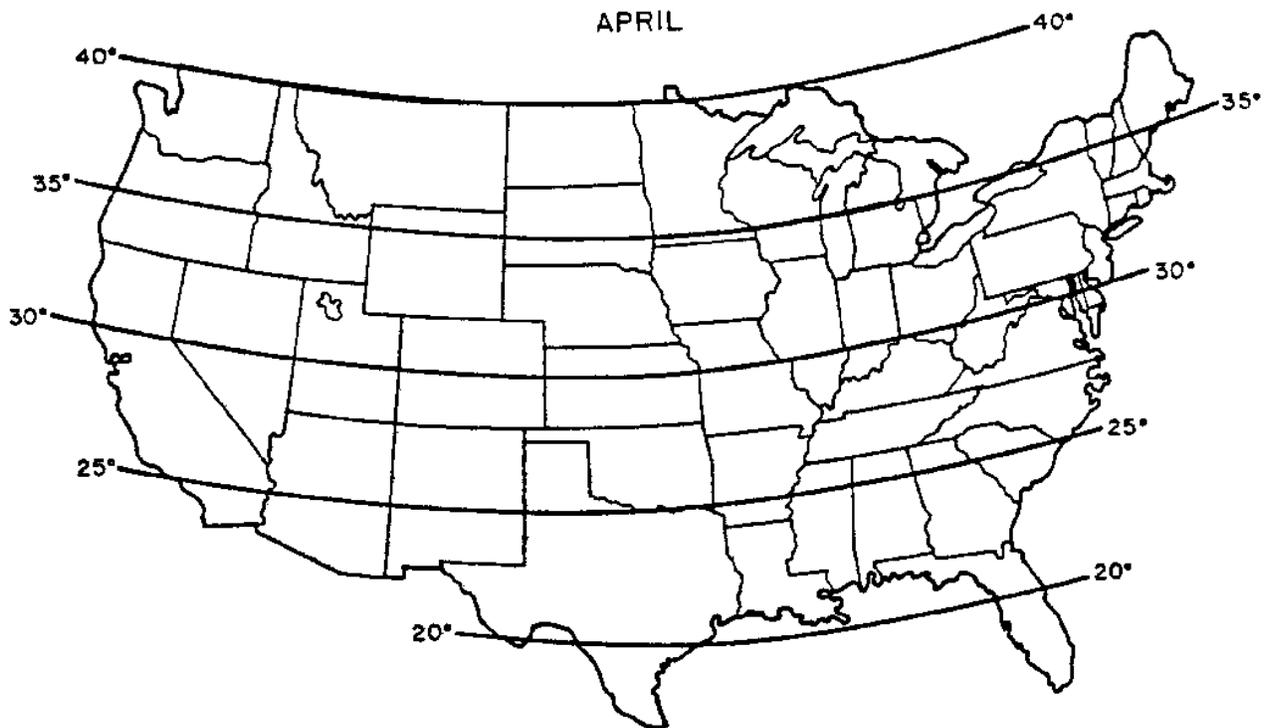


FIGURE 12(d). (Latitude - Declination) for April.

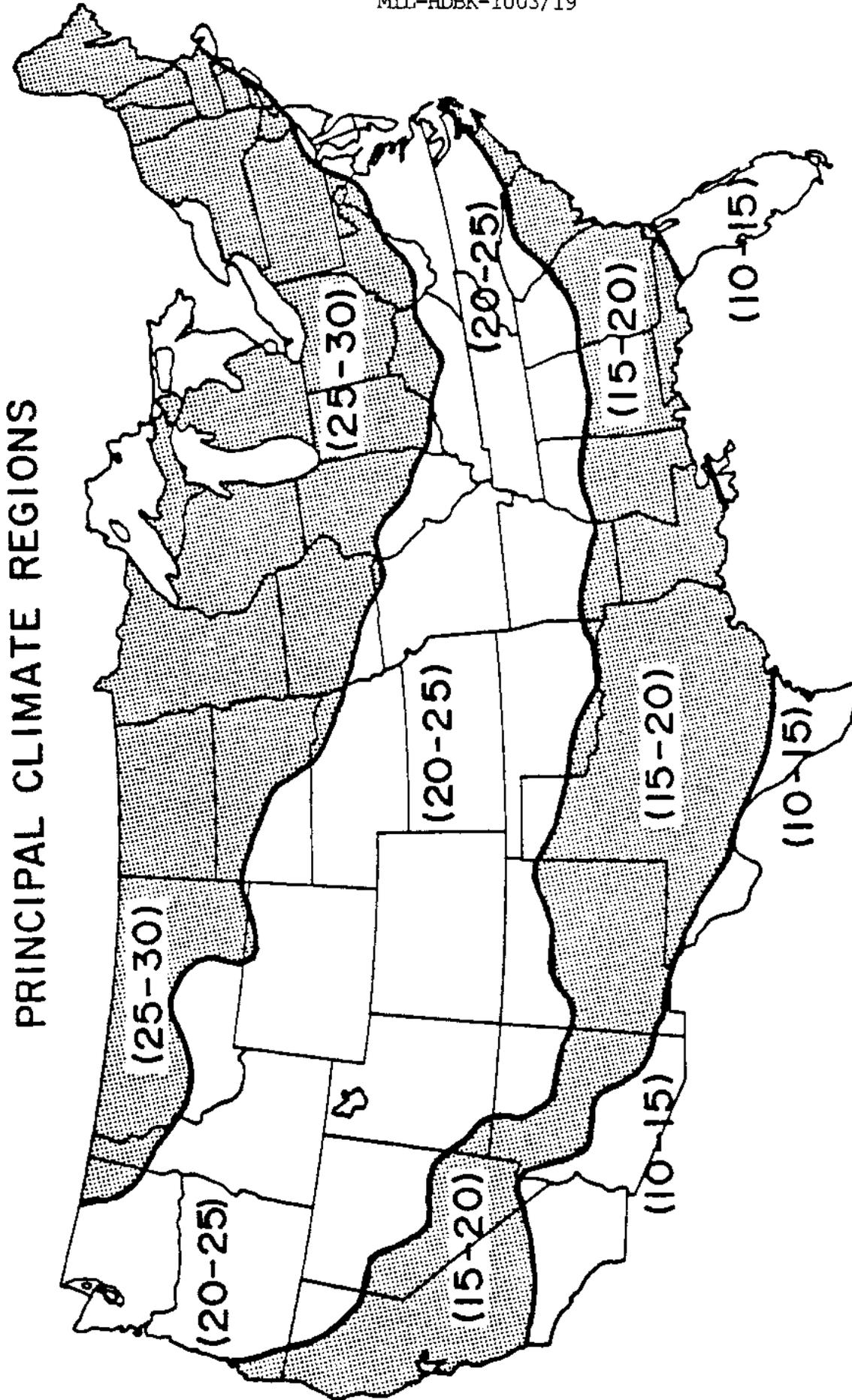


FIGURE 13. Principal climate regions (R-values).

Larger buildings derive a greater benefit from incidental heating by internal sources because of the reduced external surface area relative to the heated floor area. For two story, single family residences, townhouses, and dormitories or office buildings, the R-values of the wall insulation should be scaled down from the values in figure 13 according to the following formula:

$$RWALL = 1/3 (A_{fe} / A_{ff}) RWALL_{ref} \quad (\text{Equation 4.2})$$

where RWALL is the scaled R-value of the wall insulation and RWALL_{ref} is the reference value for a small, one story building. Furthermore, A_{fe} is the external surface area of the building (ground level floors are included, for example, but common walls between townhouse units are not), and A_{ff} is the heated floorspace of the building. Equation 4.2 credits larger buildings for their more effective utilization of internal source heating during the winter by allowing reduced levels of wall insulation.

For three reasons, it is common practice to employ higher levels of insulation in the ceiling than the wall:

- a. It is cheaper to insulate the ceiling than the wall.
- b. Stratification causes larger heat loss rates per unit area of ceiling than per unit wall area.
- c. Solar gains on roofs during the summer can cause unwanted heating of the living space beyond that caused by high ambient air temperature.

The total-R-value of the roof structure should therefore be scaled directly with the wall R-value as follows:

$$RROOF = 1.5 RWALL \quad (\text{Equation 4.3})$$

Heat losses through building perimeters and fully bermed basement walls are limited by contact with the soil so that insulation levels need not be so high as for exposed external walls. The following formulas yield reasonable insulation levels for these surfaces:

$$RPERIM = 0.75 RWALL \quad (\text{Equation 4.4})$$

$$RBASE = 0.75 RWALL \quad (\text{Equation 4.5})$$

Ordinarily, floors are not insulated so as to assure that pipes located below do not freeze. Because of widely varying conditions beneath ground level floors, it is difficult to recommend specific insulation levels. Nevertheless, provided there is no problem with pipes freezing, a reasonable value might be:

$$RFLOOR = 0.5 RWALL \quad (\text{Equation 4.6})$$

The insulation levels recommended above are intended only as starting point values. Design analysis calculations described in later sections should be performed before fixing any important design variables.

4.3.6 Infiltration. Many older buildings have infiltration rates as high as 1.5 air changes per hour (ACH). A reduction to 1.0 ACH may be achieved by employing a plastic vapor barrier; taking care to seal all joints and foam any cracks will generally further reduce the infiltration rate to 0.5 ACH. It is strongly recommended that the infiltration rate be limited to 0.5 ACH for both new construction and retrofits whenever possible. Since extremely low rates may be hazardous to the occupants' health due to the accumulation of indoor pollutants, further reductions in infiltration heat loss should be attempted only through the use of window heat recovery units. Extensive use of these units can yield effective infiltration rates as low as 0.187 and under certain circumstances, the additional expense involved may be justifiable.

4.3.7 Solar collection area. The solar collection areas recommended in this section are intended to be used as starting point values for the design analysis procedure discussed in 4.4 and 5.1; they are based on the following assumptions:

- a. The recommendations presented in the preceding sections on insulation levels and infiltration rates are followed.
- b. The levelized heating fuel cost is \$18.55/MMBtu.
- c. The heating efficiency is unity.
- d. The payback period is ten years.

The last three assumptions imply that the ratio of annual energy saved to capital invested (E/C) is 5.4 MMBtu/K\$. Furthermore, the system productivity (PR) which is defined as the amount of energy saved annually per square foot of collector, is given by the product of E/C and the system dependent cost per square foot of solar collection aperture. For small variations of the fuel costs from the assumed value of \$18.55/MMBtu, the aperture size may be adjusted at one-third the rate of fuel cost variation. In other words, a 9 percent increase in fuel cost should be compensated for by a 3 percent increase in aperture size.

Nine representative passive solar systems are included in the sizing rules presented in this section. The nine systems and their associated costs per ft² of aperture are described in table II. Thermal storage mass is characterized by the thickness in inches (THICK), and by the ratio of the mass surface area to the area of the collection aperture (A_{ms}/A_{c}). For sunspaces, the area of the collection aperture is taken to be the area projected on a vertical plane. For all systems, the thermal storage material is high density concrete.

Contour maps of recommended aperture size expressed as percent of floor area are presented in sequence for each of the systems in table II in figures 14 through 22. (Note: Large apertures occur where high solar availability coincides with a large heat load. Small apertures occur where the solar availability is low or the heat load is small.) These aperture sizes, used in conjunction with the previously recommended insulation and infiltration levels, will yield an E/C of 5.4 and a payback period of ten years for the

TABLE II. Representative passive system costs.[*]

System Number	Figure Number	System Type	Cost (\$/ft ²)
1	14	Double glazed direct gain with THICK = 4 and $A_{FM}/A_{FC} = 3$.	12
2	15	Double glazed direct gain with THICK = 4 and $A_{FM}/A_{FC} = 6$.	12
3	16	Double glazed, vented Trombe wall with THICK = 12.	15
4	17	Double glazed radiant panel with THICK = 4 and $A_{FM}/A_{FC} = 3$.	12
5	18	Double glazed radiant panel with THICK = 4 and $A_{FM}/A_{FC} =$	12
6	19	Double glazed thermosiphoning air panel with THICK = 4 and $A_{FM}/A_{FC} = 3$.	14
7	20	Double glazed thermosiphoning airpanel with THICK = 4 and $A_{FM}/A_{FC} = 6$.	14
8	21	Double glazed attached sunspace with glazing tilted 50 degrees to the horizontal and THICK = 12.	18
9	22	Double glazed semi-enclosed sunspace with vertical glazing and THICK = 12.	15

[*]Based on typical costs observed by Los Alamos National Laboratory during the 1984-1985 period.

nine systems specifically described; similar results can be achieved for other related systems by employing the contour map that is most representative of the system of interest. Similar results are achieved because related systems that operate at higher efficiencies than the six reference cases tend to be more expensive and therefore, require higher productivities in order to pay for themselves in about ten years. The higher productivities can be achieved by keeping the aperture size about equal to that recommended for the cheaper but less efficient systems included in table II. A similar argument holds for systems that are less efficient than the related reference cases.

The aperture sizes given in figures 14 through 22 are for single family detached residences with 1500 ft² of heated floorspace. For larger or multi-story buildings, the ratio of collector area to floor area should be scaled according to the following formula:

$$A_{rc}/A_{rf} = 1/3 (A_{re}/A_{rf}) (A_{rc}/A_{rf})^{0.7} \quad (\text{Equation 4.7})$$

where A_{re} is the external surface area of the building and $(A_{rc}/A_{rf})^{0.7}$ is the reference area ratio read from the appropriate contour map. This building size correction is intended to compensate for the fact that heat from internal sources provides a higher fraction of the building heat load in larger buildings.

The sizing rules presented above are intended for apertures facing due south but may be applied to cases involving departures of up to 30 degrees without incurring serious error. Generally, the performance penalty for a passive solar system that is thirty degrees off south is about 10 percent. These initial values should, as previously stated, be checked by design analysis calculations before proceeding to construction documents.

4.3.8 Thermal storage mass. The amount of thermal storage mass required per square foot of solar aperture depends primarily on the solar availability at the building site. The relative solar availability in the continental United States is given by the contour map in figure 8.

Masonry thermal storage walls and sunspaces with masonry common walls generally employ a wall thickness of about 12 inches of high density material. This thickness is quite appropriate in the sunny region and to a large extent, in the adjacent cloudy and very sunny regions. However, in the most sunny region a wall thickness of 18 inches should be employed to protect against overheating and fully utilize the available resource. In the very sunny region, wall thicknesses may range from 12 inches to 18 inches depending on which boundary the building site is nearest. At the other extreme, mass walls in the very cloudy region need only be 6 inches thick and in the adjacent cloudy region, thicknesses may range from 6 inches to 12 inches depending on position relative to the boundaries. When water containers are used for thermal storage, either in sunspaces or thermal storage walls, equivalent thicknesses comparable to those recommended for masonry walls are appropriate in all solar availability regions; however, because the heat capacity of water is roughly twice that of high density masonry, significant downward revisions may be permissible.

Direct gain apertures, radiant panels, and TAPs all use interior mass for heat storage. Ideally, the interior mass should have a high density and be distributed in thicknesses of 2 inches to 6 inches. Appropriate area ratios (A_{rm}/A_{rc}) are 3 in the very cloudy region, 3 to 6 in the cloudy region, 6 in the sunny region, 6 to 9 in the very sunny region and 9 in the most sunny region. Equivalent or somewhat smaller volumes of water may be used instead of masonry in lightly constructed buildings.

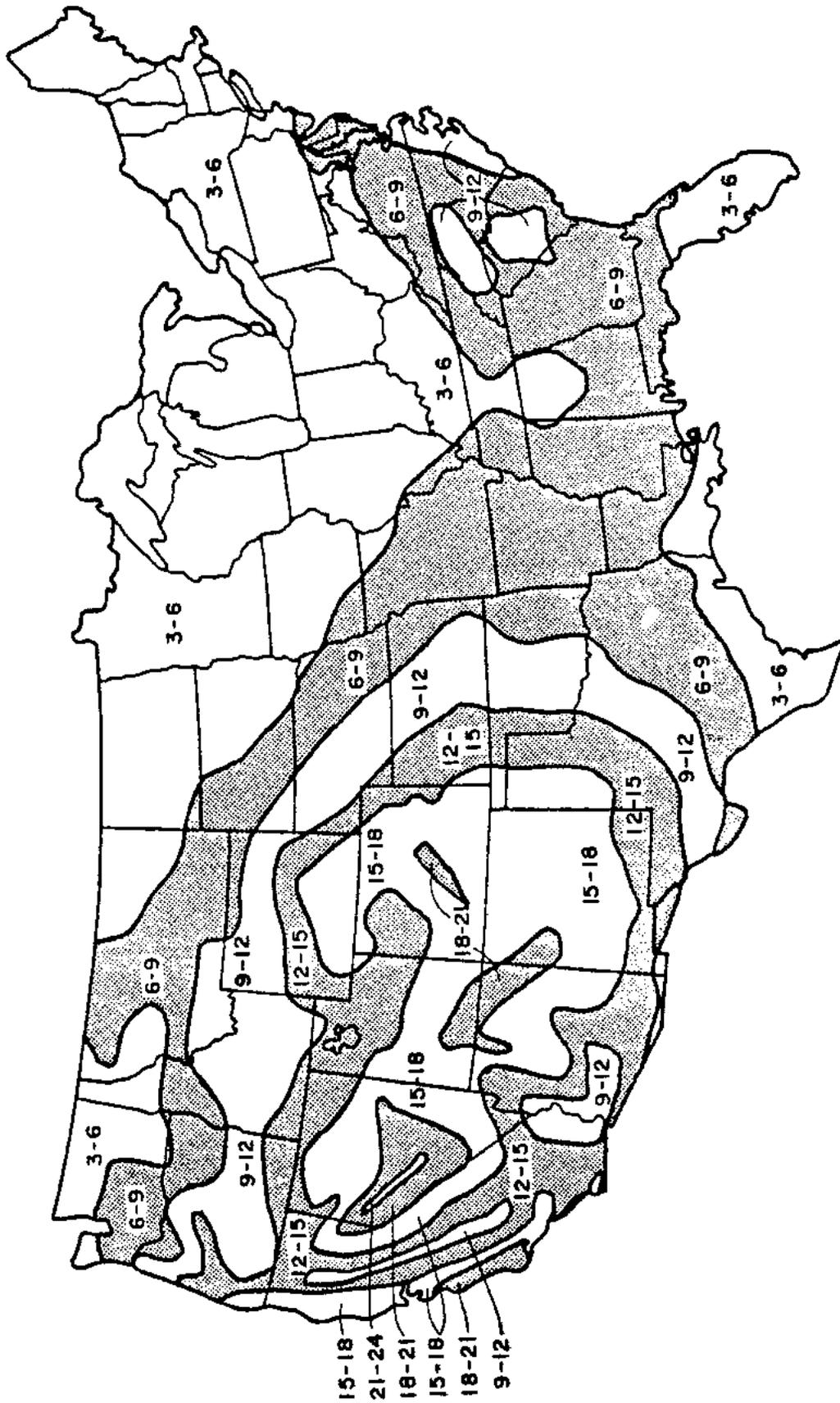


FIGURE 14. Solar aperture area in percent of floorspace area (System 1).

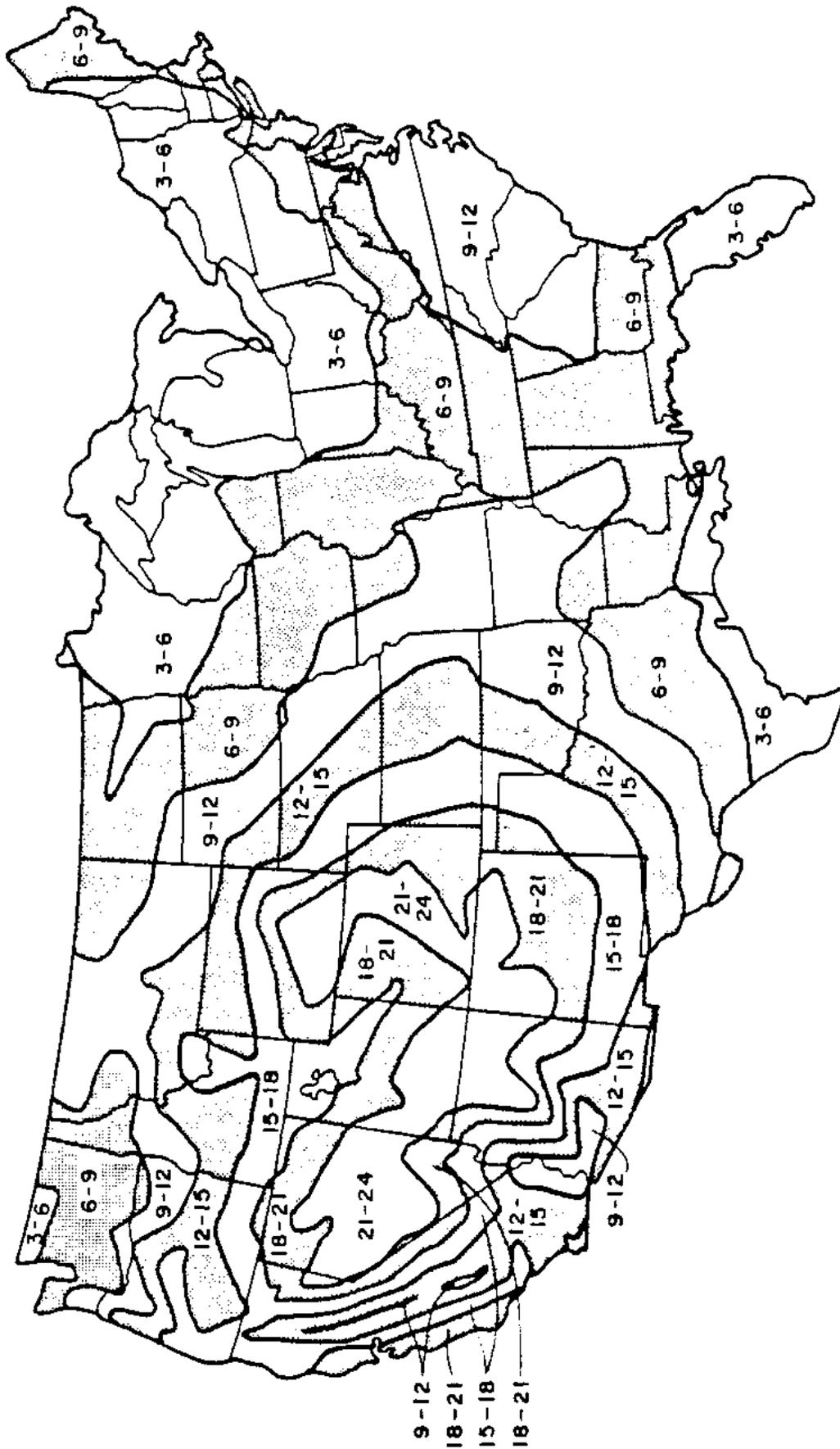


FIGURE 15. Solar aperture area in percent of floorspace area (System 2).

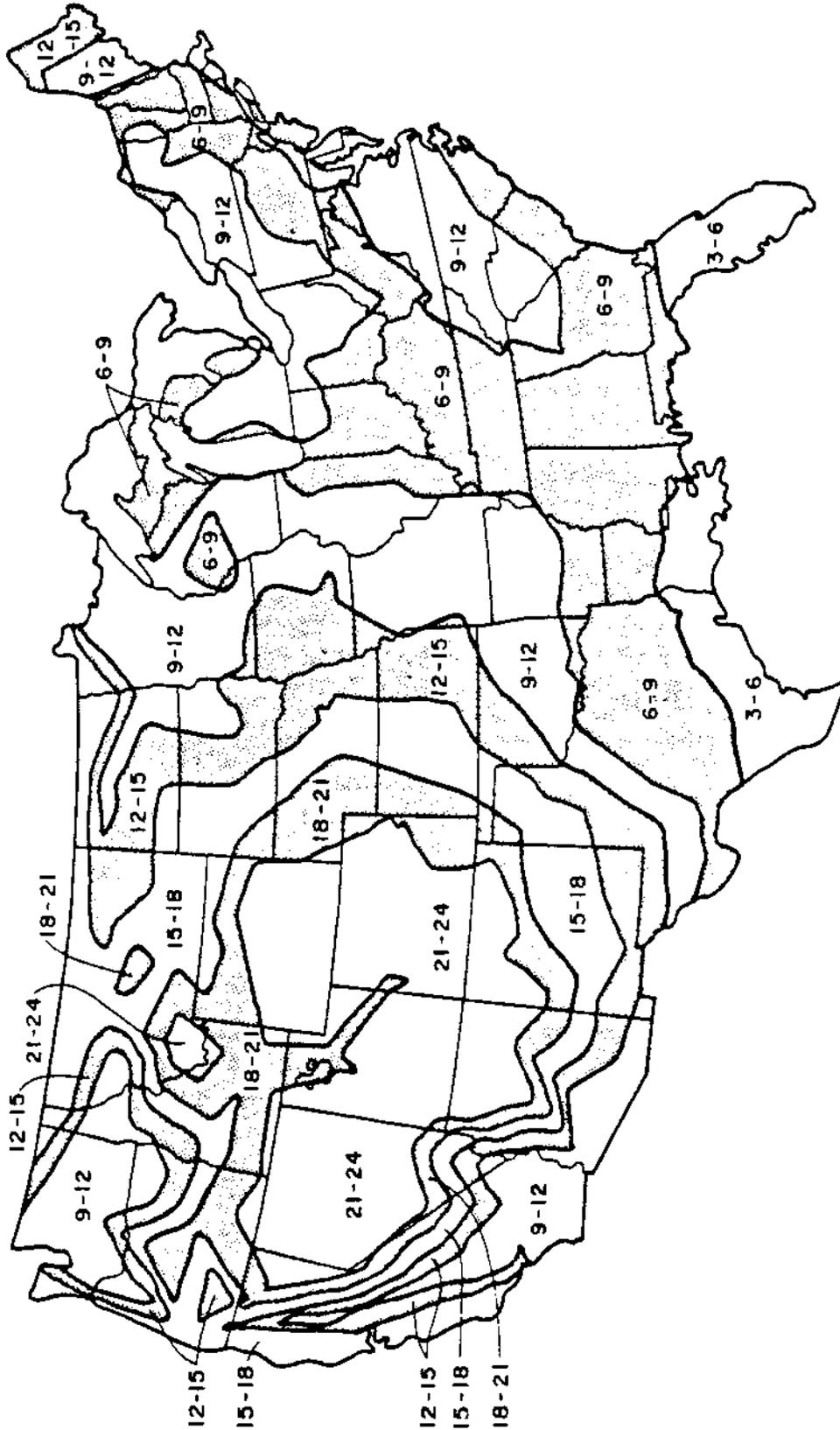


FIGURE 17. Solar aperture area in percent of floorspace area (System 4).

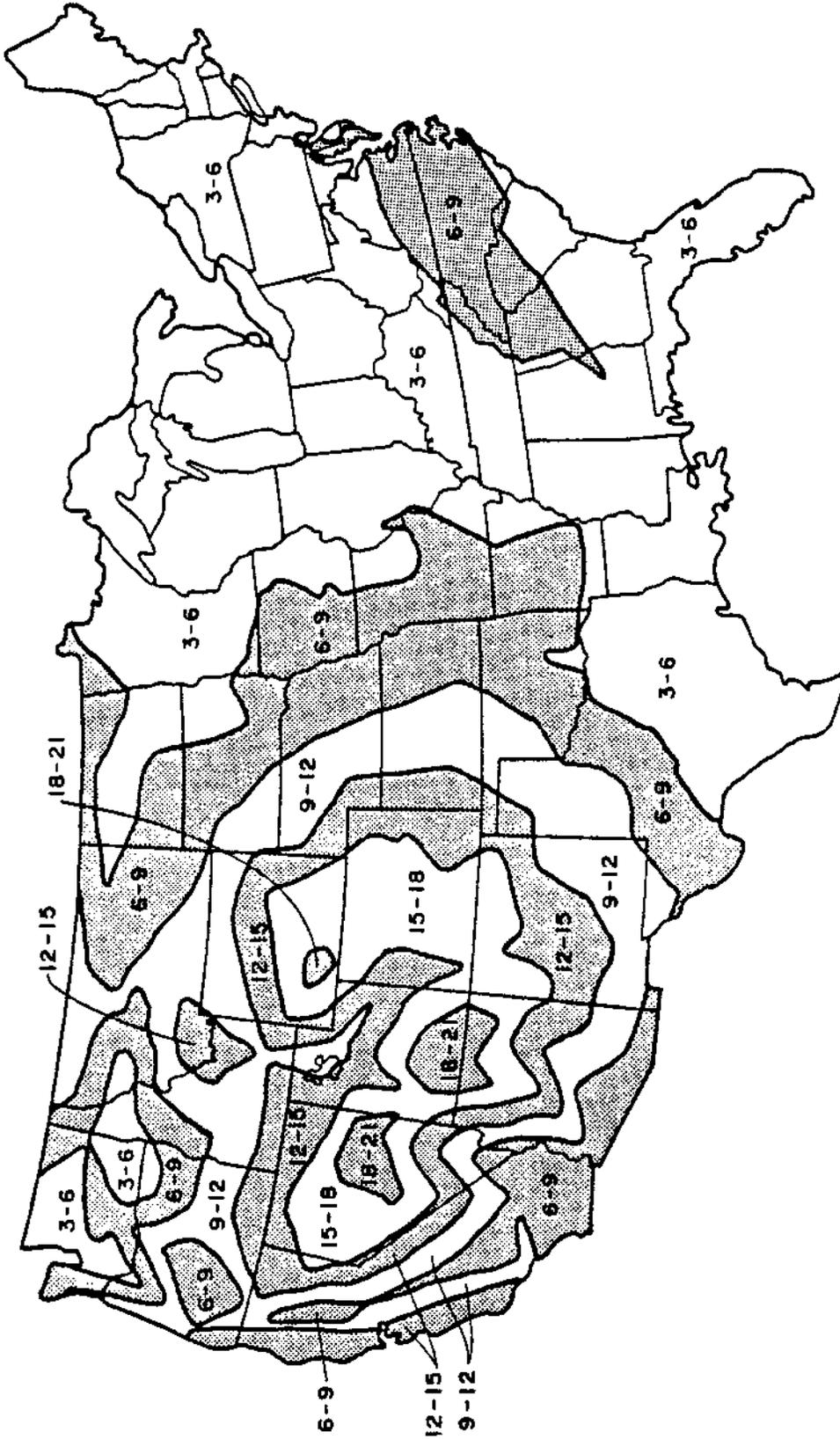


FIGURE 18. Solar aperture area in percent of floorspace area (System 5).

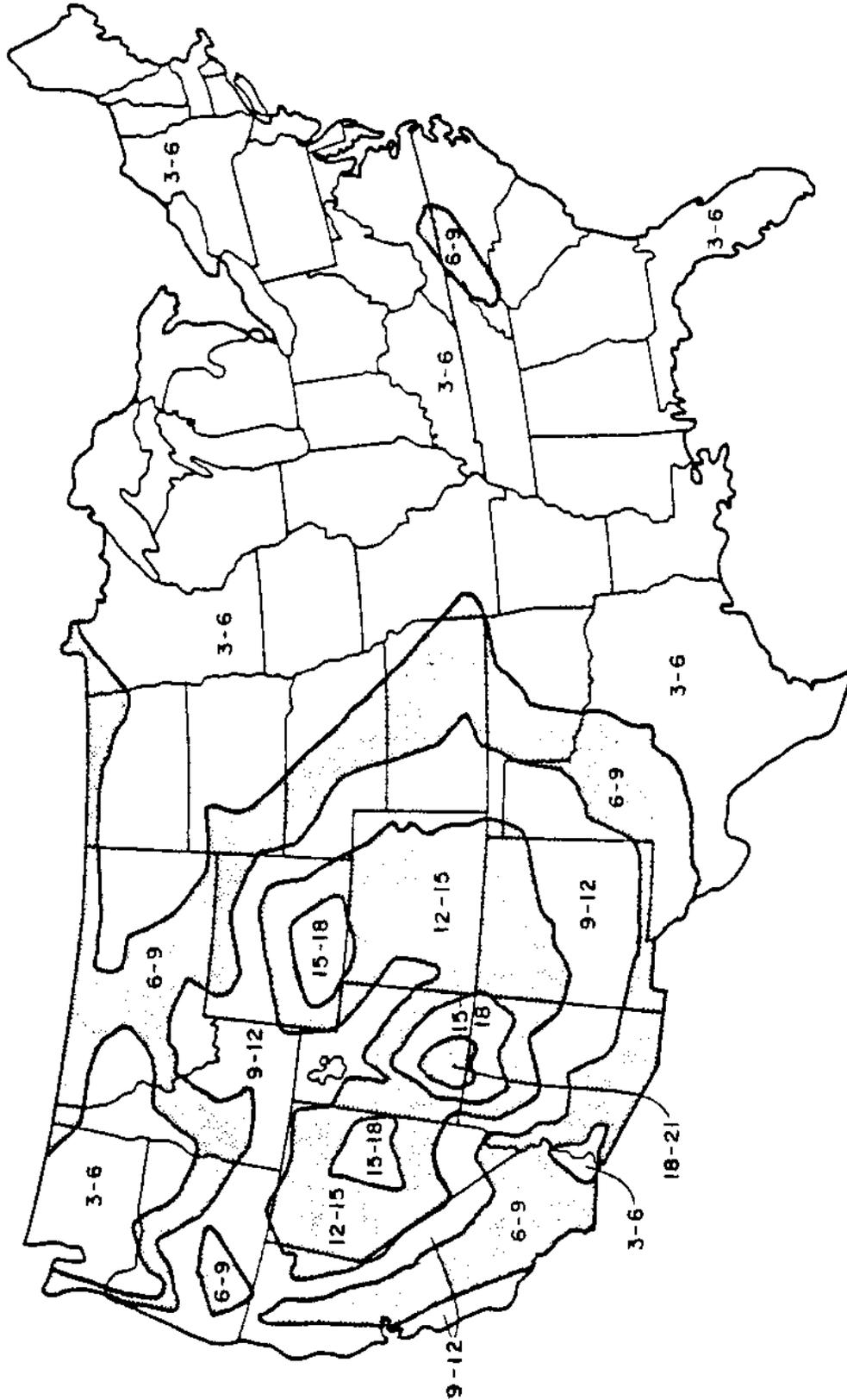


FIGURE 19. Solar aperture area in percent of floorspace area (System 6).

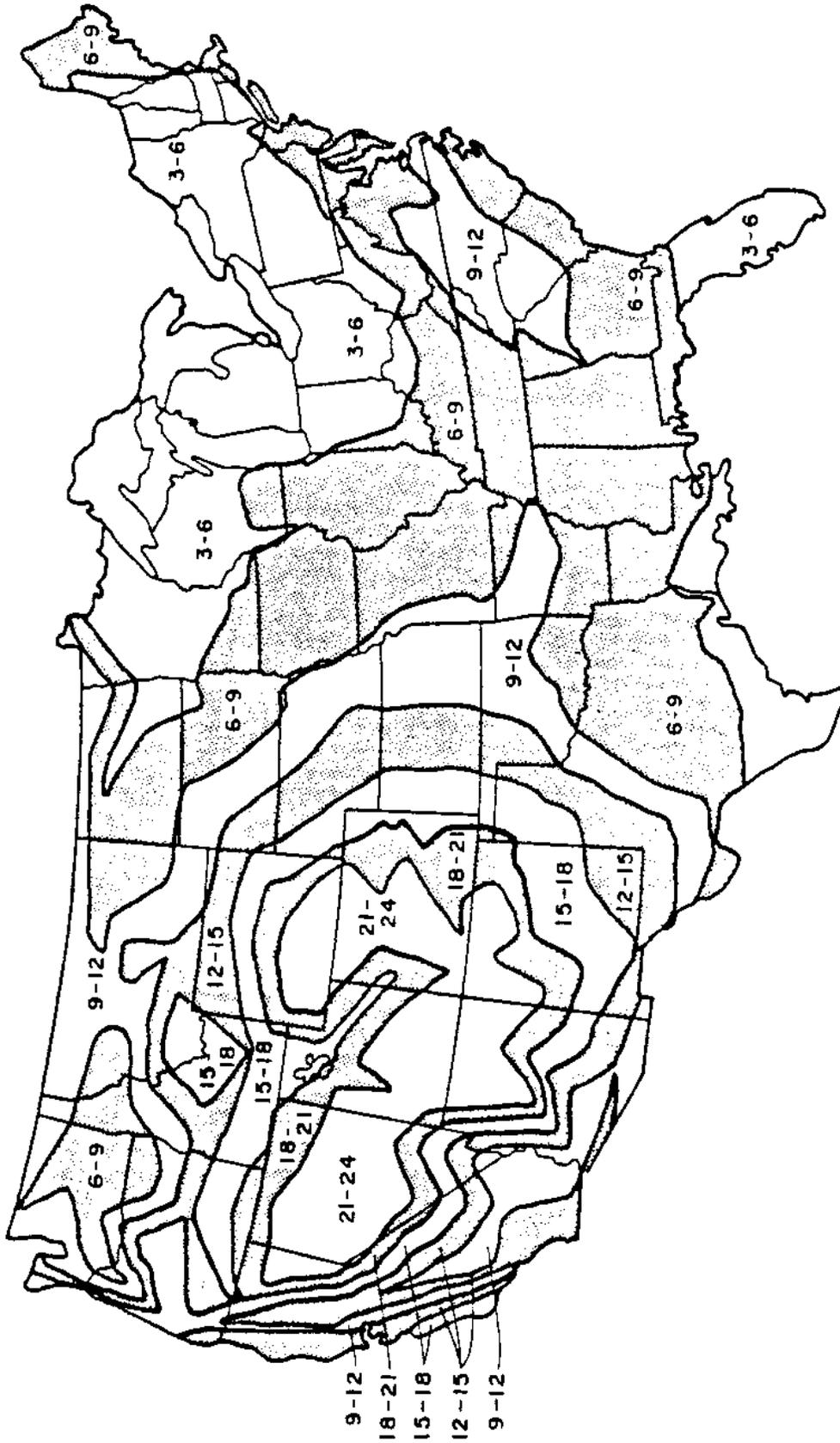


FIGURE 21. Solar aperture area in percent of floorspace area (System 8).

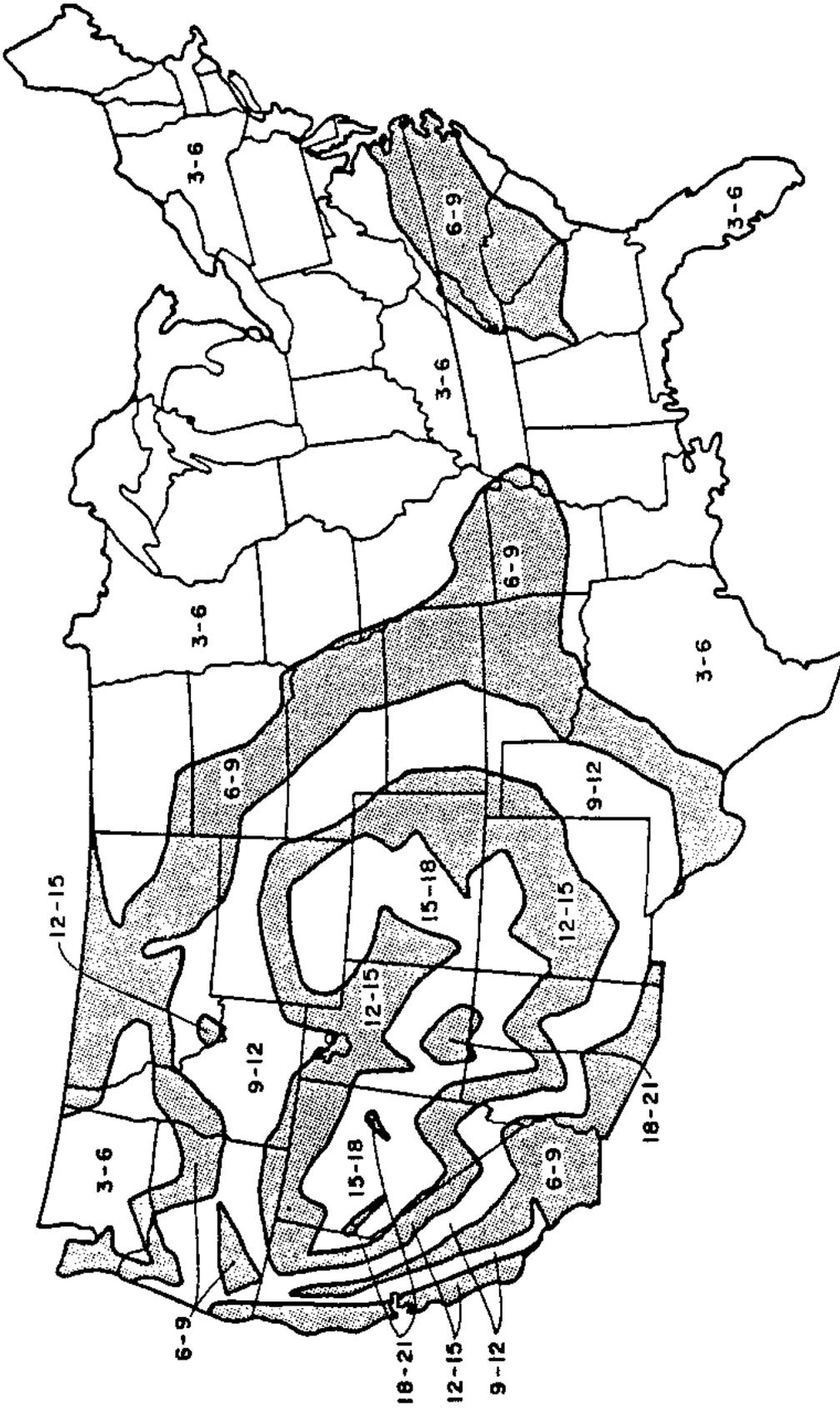


FIGURE 22. Solar aperture area in percent of floorspace area (System 9).

4.3.9 Schematic design worksheet. Worksheet 1 is provided as an aid in organizing and recording the results of the schematic design process described in this chapter. The worksheet is self-explanatory and employs previously defined notation except for the total external perimeter of the heated floorspace (P_{TE}). The floorspace may occupy one or more levels in a building, and P_{TE} comprises the external perimeter of all levels to be included in the analysis. Thus, for a two-story building that is being analyzed as a single unit, P_{TE} is the perimeter of the ground floor plus the perimeter of the upper floor. If the two-story unit is a duplex consisting of two distinct thermal zones separated by a vertical plane, it would be appropriate to analyze the thermal zones separately. In this case, the length of the common wall separating the two zones must be subtracted from the perimeter of each level of the zone under consideration.

Additional worksheets will be presented later as more detailed design analysis procedures are introduced. Having once read and understood these design procedures, the user will be able to rapidly specify appropriate starting-point values for the primary passive solar parameters. The user may then proceed to completion of a detailed method for design analysis and refinement using only the worksheets and graphical or tabular information provided in this document. An example calculation presented in 5.3 illustrates the entire process.

4.4 Fundamentals of design analysis. The guidelines presented in 4.3 should enable the designer to specify initial values for the design variables that are most strongly related to energy efficient performance in passive solar buildings. Before proceeding any further with the design, an analysis that provides an estimate of the buildings performance should be conducted. By repeating the analysis with selected values of the primary variables it is possible to fine tune the original design in a manner that is consistent with the performance and economic goals of the project. The design analysis procedure introduced herein is quick and accurate in application and therefore well suited to the design of energy efficient buildings. Before discussing the procedure, a set of essential concepts and definitions is presented below.

4.4.1 Terminology.

4.4.1.1 Solar collection area. The area of the glazed portions of the solar collection aperture (A_{SC}) has units of ft^2 .

4.4.1.2 Projected area. In order to analyze sunspaces that have tilted glazings, it is necessary to know the area of the collector that is projected on a vertical plane. The tilt relative to vertical is given by $[\theta]$, and the required relationship is:

$$A_{\text{P}} = A_{\text{SC}} \text{ [multiplied by] } \cos ([\theta]) \quad (\text{Equation 4.8})$$

The projected area (A_{P}) should be used in place of A_{SC} for design analysis work on sunspaces.

4.4.1.3 Transmitted solar radiation. The symbols VT_1 , VT_2 , and VT_3 represent the amount of solar radiation that is transmitted through one square foot of vertical, south-facing solar aperture during a specific one-month period for single, double, and triple glazed systems, respectively. The corresponding annual sums are indicated by the symbols QTA_1 , QTA_2 , and QTA_3 . In the general case for which the aperture is either tilted or not south-facing, QS is used for the monthly sum and QSA represents the annual sum. The units of all transmitted radiation quantities are (Btu/ft²) per unit time.

4.4.1.4 Solar aperture absorptance. The solar aperture absorptance (α) is the fraction of transmitted solar radiation that is absorbed by the passive heating system. The part not absorbed is lost back through the glazing by reflection.

4.4.1.5 Absorbed solar radiation. The amount of radiation absorbed by a passive solar heating system per square foot of aperture (S) is given by the product of the transmitted radiation and the absorptance. In the general case, for a one-month period, we have:

$$S = \alpha \text{ [multiplied by] } QS. \quad (\text{Equation 4.9})$$

The units of S are (Btu/ft²) per unit time. The total amount of solar radiation absorbed by a particular system (S_T) is given by the product of S and A_T (or A_p where appropriate) and has units of Btu per unit time.

4.4.1.6 Net load coefficient. The net load coefficient (NLC) is defined as the amount of heat that would be required to maintain the air temperature in a building 1 deg.F above the outdoor ambient temperature for a period of one day if no heat losses or gains were allowed through the solar aperture. Thus the NLC, which is expressed in units of Btu/deg.F-day, provides a measure of how effectively the nonsolar elements of a building have been sealed and weatherstripped to reduce infiltration and insulated to reduce heat loss by conduction. A procedure for obtaining a quick estimate of the NLC will be presented in 5.1.1.

4.4.1.7 Load collector ratio. The load collector ratio (LCR) is the NLC divided by the solar collection area (A_T), or, in the case of sunspaces with tilted glazings, it is the NLC divided by the projected area (A_p). The units of LCR are Btu/deg.F-day ft² and the defining equation is:

$$LCR = NLC/A_T \quad (\text{Equation 4.10})$$

4.4.1.8 Total load coefficient. The total load coefficient (TLC) is the sum of the NLC and the load coefficient of the solar aperture and as such, provides a measure of the total building heat loss with no credit taken for solar gains.

One of two values for the solar aperture conductance may be selected depending on the application at hand. If the steady state aperture conductance (U_T), expressed in Btu/hr-ft²-deg.F, is selected, then:

$$TLC_T = NLC + 24 \text{ [multiplied by] } U_T \text{ [multiplied by] } A_T \quad (\text{Equation 4.11})$$

where TLC_{rs} is the steady state total load coefficient. If on the other hand, the effective aperture conductance (G), expressed in Btu/deg.F-day ft², is selected, then:

$$TLC_{re} = NCL + G \text{ [multiplied by] } A_{rc} \quad (\text{Equation 4.12})$$

where TLC_{re} is the effective total load coefficient. The effective conductance (G) is a system correlation parameter, as will be expanded on in 5.1.1, and includes the effect of solar aperture dynamics. The appropriate choice of TLC parameters will be specified for each application in these procedures.

4.4.1.9 Thermostat setpoint. The thermostat setpoint (T_{rset}) is the temperature setting of the thermostat that controls the auxiliary heating system.

4.4.1.10 Diurnal heat capacity. The diurnal heat capacity (DHC) is the amount of heat that can be stored in the thermal mass of a building, per unit room air temperature swing, during the first half of a 24-hour cycle and returned to the space during the second half of the cycle. The performance of passive solar buildings is enhanced when the DHC is elevated. Procedures for calculating this important parameter will be presented in 5.1. The DHC has units of Btu/deg.F.

4.4.1.11 Effective heat capacity. The effective heat capacity (EHC) is a correlating parameter that relates the thermal performance of otherwise identical direct gain buildings that have arbitrary thermal storage media arranged in various geometric configurations. As such, the EHC, which has units of Btu/deg.F of solar aperture, provides a measure of the amount of heat that may be stored in the thermal mass of a building during one day and returned to the room air on the same day or on succeeding days at times and rates that lead to improvements in building performance. Improvements in solar thermal performance occur when stored solar energy is delivered to the room air in phase with the building thermal load, thereby reducing auxiliary heating requirements. A nomograph for the EHC will be presented in 5.1.

4.4.1.12 Effective thermostat setpoint. The analysis methods presented in this document require the use of a constant thermostat setpoint. Because control strategies involving nighttime setbacks are advantageous due to the resultant reduction in auxiliary heat consumption, a procedure has been developed for relating building and control parameters to a constant effective thermostat setpoint (T_{re}); this procedure is described in 5.1. The temperature T_{re} should be used in place of T_{rset} for the analysis of any building that employs a control strategy.

4.4.1.13 Base temperature. The base temperature (T_{rb}) is the thermostat setpoint (or the effective setpoint) adjusted in a manner that accounts for internal-source heating by people, lights, appliances, office equipment, or any other device not primarily intended as an auxiliary heat source. The base temperature is given by:

$$T_{rb} = T_{rset} - Q_{rint} / TLC_{rs}, \quad (\text{Equation 4.13})$$

where Q_{int} (Btu/day) is the internal heat generation rate. Use of T_{ib} rather than T_{set} in heat loss calculations is a simple and reasonably accurate way to include the effect of internal source heating on building performance. Unless other information is available, Q_{int} can be taken equal to 20,000 Btu/day per person.

4.4.1.14 Heating degree days. The heating degree days (DD) is the hourly summation of the difference between a specified base temperature and the ambient temperature for a certain time interval, where only positive terms are included in the summation, and the result is divided by 24. The units of DD are deg.F-day and the time interval of interest is generally one month or one year.

4.4.1.15 Effective building heat load. The effective building heat load (Q_{L}) is given by the product of the effective total load coefficient and the heating degree days for the time period of interest. Thus:

$$Q_{L} = TLC_{e} \text{ [multiplied by] DD ,} \quad (\text{Equation 4.14})$$

where the units of Q_{L} are Btu.

4.4.1.16 Net building heat load. The net building heat load (Q_{N}) is the product of the net load coefficient and the heating degree days for the time period of interest. The defining equation is:

$$Q_{N} = NLC \text{ [multiplied by] DD ,} \quad (\text{Equation 4.15})$$

and the units are Btu.

4.4.1.17 Steady state heat load. The steady state heat load (Q_{SL}) is the actual total heat load for a specified time period. The defining equation is:

$$Q_{SL} = TLC_{s} \text{ [multiplied by] DD} \quad (\text{Equation 4.16})$$

and the units are Btu.

4.4.1.18 Solar load ratio. The solar load ratio (SLR) is the ratio of the amount of solar radiation absorbed by the system to the effective building heat load. The defining equation is

$$SLR = S \text{ [multiplied by] } A_{fc} / Q_{L} \text{ ,} \quad (\text{Equation 4.17})$$

or

$$SLR = S_{T} / Q_{L} \quad (\text{Equation 4.18})$$

For tilted apertures in sunspaces, A_{fp} must be substituted for A_{fc} . The solar load ratio is dimensionless.

4.4.1.19 Auxiliary heat requirement. The auxiliary heat requirement (Q_{rA}) is the amount of heat that must be supplied by a conventional back-up heating system to maintain the building temperature at T_{rset} for a specified time period; the time period of interest usually has a duration of one month or one year. If a building receives no solar heat, Q_{rA} will equal the building heat load whereas Q_{rA} will be zero if the entire load is met by solar energy. The auxiliary heat requirement is the bottom line measure of passive solar heating performance.

4.4.1.20 Solar heating fraction. The solar heating fraction (SHF) is defined by the equation:

$$SHF = 1 - Q_{rA}/Q_{rL} \quad , \quad (\text{Equation 4.19})$$

and is dimensionless.

4.4.2 Heat to load ratio nomograph. The primary design analysis tool provided in these procedures is the nomograph for the annual heat to load ratio, $(Q_{rA}/Q_{rL})_{ra}$, presented in figure 23. In this figure, the quantity $(Q_{rA}/Q_{rL})_{ra}$ is plotted as a function of the minimum monthly scaled solar load ratio, SLR^* , for a series of values for the city parameter (a). The city parameter depends primarily on geographic location; tabulated values are presented in the weather tables in Appendix B, which will be fully explained in 5.1. The scaled solar load ratio is given by the relation:

$$SLR^* = F \text{ [multiplied by] } SLR_{rma} \quad , \quad (\text{Equation 4.20})$$

where F is a system dependent scale factor that is tabulated along with G , U_{rc} , and other system-dependent parameters in Appendix A; a complete explanation of Appendix A is included in 5.1. The quantity SLR_{rma} is the minimum monthly solar load ratio for the building of interest at the selected location; SLR_{rma} can easily be evaluated using data provided in the weather tables.

Having obtained the heat to load ratio from figure 23, it is an easy matter to calculate the annual auxiliary heat requirement as follows:

$$(Q_{rA})_{ra} = (Q_{rA}/Q_{rL})_{ra} \text{ [multiplied by] } (Q_{rL})_{ra} \quad , \quad (\text{Equation 4.21})$$

where $(Q_{rL})_{ra}$ is the annual effective building heat load.

4.4.3 System efficiencies.

4.4.3.1 Delivery efficiency. The delivery efficiency (e_{rd}) is defined as the fraction of absorbed solar energy that is actually delivered to the living space, or:

$$e_{rd} = Q_{rD}/S_{rT} \quad , \quad (\text{Equation 4.22})$$

where Q_{rD} is the delivered energy.

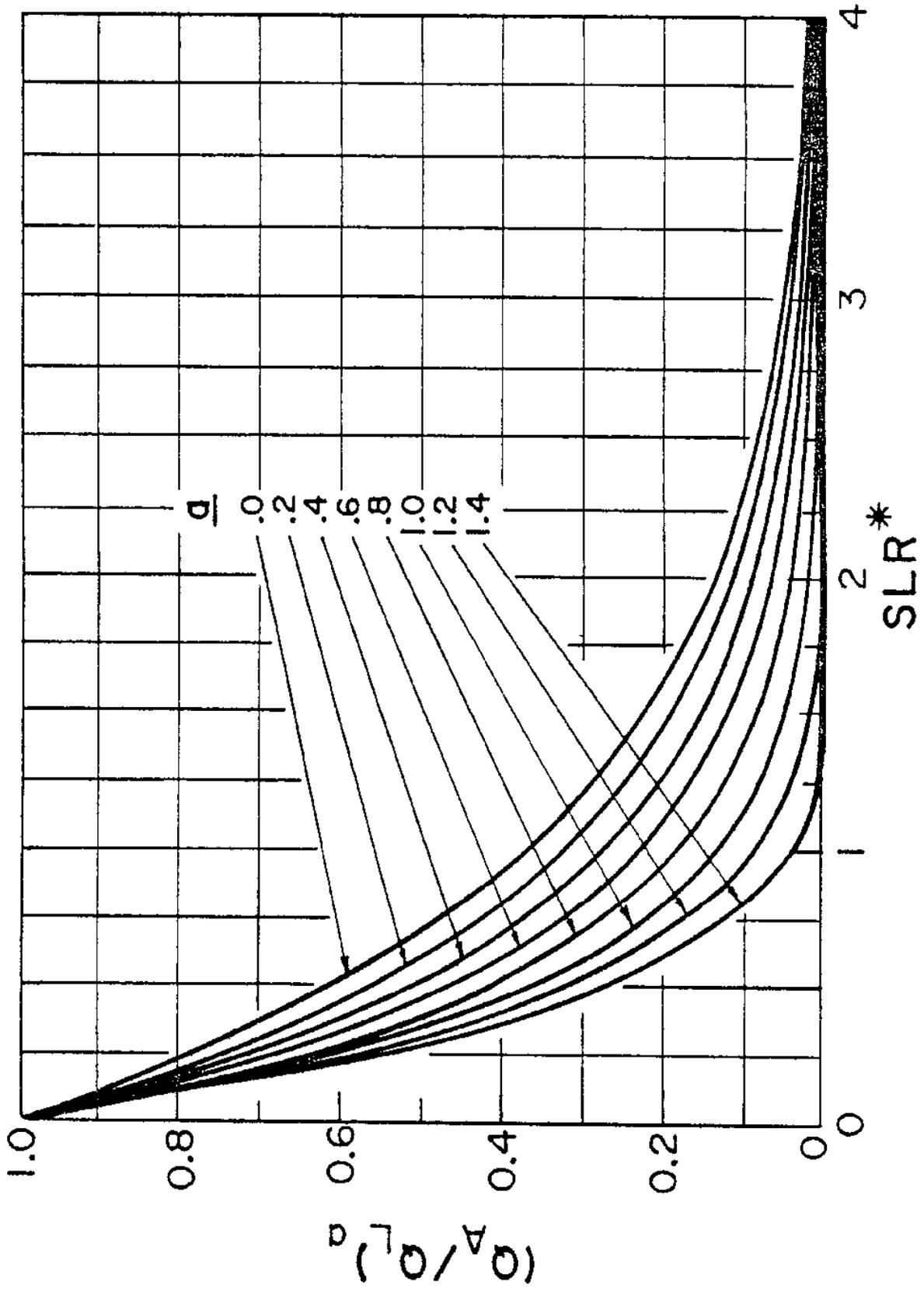


FIGURE 23. Annual heat to load ratio.

Direct gain buildings have a delivery efficiency of unity because the living space itself is the solar collector. Thermal storage walls, on the other hand, absorb energy on their outer surface and deliver heat to the interior by conduction through a masonry medium or by convection through water. Radiant panels must radiate and convect heat to the interior subsequent to absorption on the outer surface whereas TAPs convect heat to the interior through vents provided for that purpose. Regardless of what transport mechanism is involved, all passive solar systems except direct gain have delivery efficiencies less than one because part of the absorbed energy is lost back out through the glazing before it can be delivered to the interior. The delivery efficiencies of all passive solar systems addressed in this document are tabulated in Appendix A.

4.4.3.2 Utilization efficiency. The utilization efficiency ($e_{\Gamma U\gamma}$) is the fraction of delivered solar energy that provides useful heat. The defining equation is:

$$e_{\Gamma U\gamma} = Q_{\Gamma S\gamma} / Q_{\Gamma D\gamma} \quad , \quad (\text{Equation 4.23})$$

where:

$$Q_{\Gamma S\gamma} = Q_{\Gamma SL\gamma} - Q_{\Gamma A\gamma} \quad , \quad (\text{Equation 4.24})$$

is the utilizable solar heat. Systems with low utilization efficiencies are to be avoided because delivered solar energy that is not utilizable must be vented to avoid overheating the building. Typically, direct gain systems will have relatively low utilization efficiencies although overheating can be kept within acceptable limits by sizing the aperture properly and providing adequate thermal storage mass.

4.4.3.3 Total efficiency. The total system efficiency ($e_{\Gamma T\gamma}$) is the fraction of absorbed solar energy that ultimately provides useful solar heat, or:

$$e_{\Gamma T\gamma} = Q_{\Gamma S\gamma} / S_{\Gamma T\gamma} \quad , \quad (\text{Equation 4.25})$$

which is equivalent to:

$$e_{\Gamma T\gamma} = e_{\Gamma D\gamma} \text{ [multiplied by]} e_{\Gamma U\gamma} \quad (\text{Equation 4.26})$$

Thus, $e_{\Gamma T\gamma}$ depends on the efficiencies of delivery and utilization, and is an excellent measure of solar heating potential.

5. DETAILED ENGINEERING

5.1 Applied design analysis.

5.1.1 Net load coefficient worksheet. A simple procedure for estimating the net load coefficient is presented in this section. The method was adapted from DOE/CS-0127/2 and DOE/CS-0127/3, DOE Passive Solar Design Handbook, Volumes Two and Three; and although originally intended for single-family detached residences and small office buildings, is readily applicable to more complex structures.

The procedure consists of adding together several estimated contributions to building heat loss as outlined on Worksheet 2. In order to determine the heat loss contributions, a number of design parameters must be specified. Start by recording the total external perimeter ($P_{\Gamma T}$) from Worksheet 1. Next, specify the area ($A_{\Gamma G}$), and external perimeter ($P_{\Gamma G}$) of the ground floor alone followed by the horizontally projected roof area ($A_{\Gamma R}$) and the total south wall area ($A_{\Gamma S}$) including windows and other solar apertures.

Continuing to specify parameters for Worksheet 2, you will need the ceiling height (h) and the non-south window fraction (NSF) which is defined as the fraction of all external walls, except that facing south, that is occupied by windows. The non-south window fraction will normally be between 0.05, for a situation with minimal window area, and 0.10 for a case with ample window area. Next, enter the number of glazings in the non-south windows ($NGL_{\Gamma N}$) and the infiltration rate in air changes per hour (ACH). Finish this part of the worksheet by entering the air density ratio (ADR) which is a function of elevation as illustrated in figure 24. Since many Navy bases are located near sea level an ADR of unity is frequently appropriate.

In the next part of Worksheet 2, two parameters, the non-south window area ($A_{\Gamma N}$) and the wall area ($A_{\Gamma W}$) must be calculated using previously recorded quantities. The wall area is defined as the total area of all external walls excluding windows and solar apertures.

The various contributions to building heat loss are calculated and summed in the final part of the worksheet. The necessary equations are given and all parameters called for are available from the first two parts of Worksheet 2 or from Worksheet 1. A list of R-values of building materials from NCEL CR 82.002 is presented in table III and R-values for air films and air spaces, also from NCEL CR 82.002 are given in table IV. The original source of the data is the ASHRAE Fundamentals Handbook. The information in tables III and IV is useful for calculating the total R-value of layered elements in the building shell; simply add together the R-values of each layer, air gap and air film to get the total R-value.

Calculate RROOF of a vaulted ceiling with no attic by determining the total R-value of the roof and scaling that value to the horizontally projected area as follows:

$$RROOF = R_{\Gamma tot} \text{ [multiplied by] } (A_{\Gamma a} / A_{\Gamma r}) \quad , \quad \text{(Equation 5.1)}$$

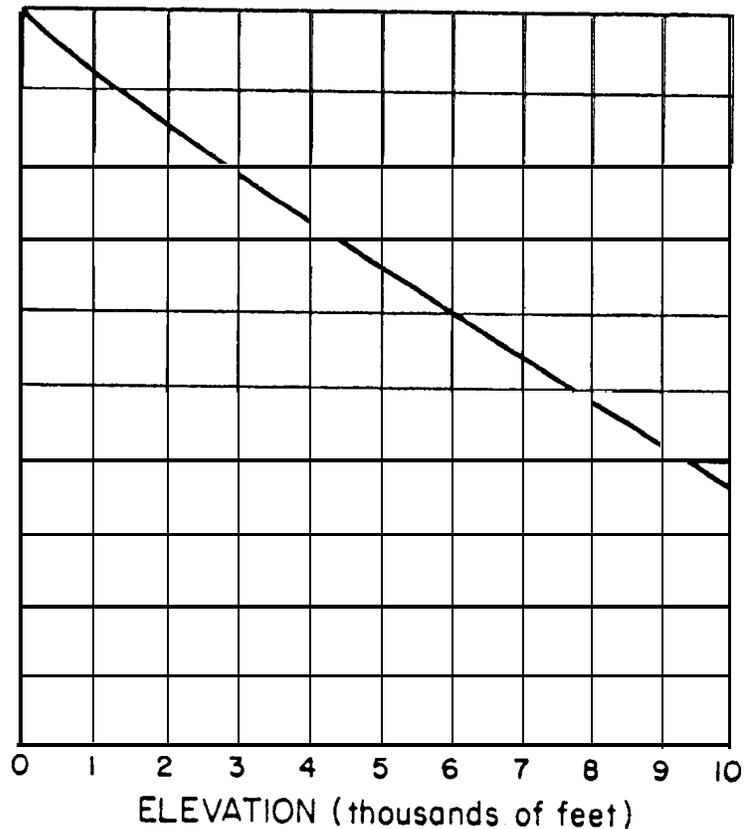


FIGURE 24. Air density ratio versus elevation.

where A_a is the actual roof area and R_{tot} is the total R-value of the roof element. If the roof is pitched over a horizontal ceiling with an attic, two possibilities exist: (1) If the attic is vented R_{ROOF} is the total R-value of the ceiling alone; (2) If the attic is not vented, R_{ROOF} is the sum of the roof contribution, given by equation 5.1, and the ceiling contribution, plus an allowance for the air gap between the two. If the surfaces bounding the attic are non-reflective, use an R-value of 0.6 for the air gap and a value of 1.3 if the surfaces are highly reflective.

Worksheet 2 is designed to help the user obtain an estimate of the NLC after completing the schematic design process outlined on Worksheet 1. Alternately, the second worksheet may be used as the starting point on subsequent trial designs as the user iterates to improve the performance of his building.

If the building of interest is a townhouse or other larger structure containing more than one control zone, Worksheet 2 may still be used to estimate the NLC. By including the complete structure in the analysis, as though only one thermal zone were present, one can determine the overall loss characteristics of the building and estimate the total size of all solar apertures required to provide a certain level of performance. However, this overall approach does not help the user to partition the solar aperture among the various thermal zones.

TABLE III. R-Factors of building materials.

Material and Description	Density (lb/ft ³)	R-Value	
		per inch thickness	for listed thickness
Building boards, panels, flooring			
Asbestos cement board	120	0.25	--
Asbestos cement board 1/8-inch	120	--	0.03
Gypsum or plaster board 3/8-inch	50	--	0.32
Gypsum or plaster board 1/2-inch	50	--	0.45
Plywood (see Siding materials)	34	1.25	--
Sheating, wood fiber (impregnated or coated) 25/32-inch	20	--	2.06
Wood fiber board (laminated or homogenous)	26	2.38	--
Wood fiber, hardboard type	65	0.72	--
Wood fiber, hardboard type 1/4-inch	65	--	0.18
Wood subfloor 25/32-inch	--	--	0.98
Wood hardwood finish 3/4-inch	--	--	0.68
Building paper			
Vapor-permeable felt	--	--	0.06
Vapor-seal, 2 layers of mopped 15 lb felt	--	--	0.12
Vapor-seal plastic film	--	--	negl.
Finish materials			
Carpet and fibrous pad	--	--	2.08
Carpet and rubber pad	--	--	1.23
Cork tile 1/8-inch	--	--	0.28
Terrazzo 1-inch	--	--	0.08
Tile (asphalt, linoleum, vinyl, rubber)	--	--	0.05
Gypsum board 1/2-inch	--	--	0.45
Gypsum board 5/8-inch	--	--	0.56
Hardwood flooring 25/32-inch	--	--	0.68
Insulating materials			
Blankets and batts:			
Mineral wool, fibrous form (from rock, slag, or glass)	0.5 1.5-4.0	3.12	--
Wood fiber	3.2-3.6	4.00	--
Boards and slabs:			
Cellular glass 30deg.F	9	2.70	--
Cork board 30deg.F	6.5-8.0	3.85	--
" 30deg.F	12	3.45	--
Glass fiber 90deg.F	4.0-9.0	3.85	--
" 30deg.F		4.55	--
Expanded rubber (rigid) 75deg.F	4.5	4.55	--
Expanded polyurethane (R-11 blown;			
1-inch thickness or more) 100deg.F	1.5-2.5	5.56	--
" 25deg.F		5.88	--
Expanded polystyrene, extruded			
75deg.F	1.9	3.85	--
30deg.F		4.17	--

TABLE III. R-Factors of building materials. (Cont.)

Material and Description	Density (lb/ft ³)	R-Value		
		per inch thickness	for listed thickness	
Expanded polystyrene molded beads	75deg.F 30deg.F	1.0	3.57 3.85	-- --
Mineral fiberboard				
Core or roof insulation		16-17	2.94	--
Acoustical tile		21	2.70	--
Mineral fiberboard, molded acoustical tile		23	2.38	--
Wood or cane fiberboard				
acoustical tile	1/2-inch	--	--	1.19
interior finish		15	2.86	--
insulating roof deck	1-inch	--	--	2.78
	2-inch	--	--	5.56
	3-inch	--	--	8.33
Shredded wood (cemented, preformed slabs)		22	1.67	--
Loose fills:				
Macerated paper or pulp		2.5-3.5	3.57	--
Mineral wool	90deg.F 30deg.F	2.0-5.0	3.33 4.10	-- --
Perlite (expanded)	90deg.F 30deg.F	5.0-8.0	2.63 2.74	-- --
Vermiculite (expanded)	90deg.F 30deg.F	7.0-8.2	2.08 2.27	-- --
Sawdust or shavings		8.0-15	2.22	--
Masonry materials, concretes				
Cement mortar		116	0.20	--
Gypsum-fiber concrete (87.5 percent gypsum, 12.5 percent concrete)		51	0.60	--
Lightweight aggregates		120	0.19	--
(expanded shale, clay or slate;		100	0.28	--
expanded slags, or cinders;		80	0.40	--
pumice; perlite or vermiculite;		60	0.59	--
cellular concretes)		40	0.86	--
		20	1.43	--
Sand and gravel or stone aggregate (oven-dried)		140	0.11	--
Sand and gravel or stone aggregate (not-dried)		140	0.08	--
Stucco		116	0.20	--
Masonry units				
Brick, common (typical value)		120	0.20	--
Brick, face (typical value)		130	0.11	--
Clay tile, hollow				
1 cell deep	3-inch	--	--	0.80
1 cell deep	4-inch	--	--	1.11
2 cells deep	6-inch	--	--	1.52
2 cells deep	8-inch	--	--	1.85
3 cells deep	10-inch	--	--	2.22
3 cells deep	12-inch	--	--	2.50

TABLE III. R-Factors of building materials. (Cont.)

Material and Description	Density (lb/ft ³)	R-Value	
		per inch thickness	for listed thickness
Concrete block, 3 oval core			
Sand and gravel aggregate			
4-inch	--	--	0.71
8-inch	--	--	1.11
12-inch	--	--	1.28
Cinder aggregate			
3-inch	--	--	0.86
4-inch	--	--	1.11
8-inch	--	--	1.72
12-inch	--	--	1.89
Lightweight aggregate (expanded shale, clay or slate or slag; pumice)			
3-inch	--	--	1.27
4-inch	--	--	1.50
8-inch	--	--	2.00
12-inch	--	--	2.72
Concrete blocks, rectangular core			
Sand and gravel aggregate			
2 core, 36 lb[*]	8-inch	--	1.04
same, filled cores[**]		--	1.93
Lightweight aggregates			
3 core, 19 lb[*]	6-inch	--	1.65
same, filled cores[**]		--	2.99
2 core, 24 lb[*]	8-inch	--	2.18
same, filled cores[**]		--	5.03
3 core, 38 lb[*]	12-inch	--	2.48
same, filled cores[**]		--	5.82
Stone, lime or sand		--	0.08
Granite, marble	150-175	--	0.05
Adobe			
10-inch	--	--	2.78
14-inch	--	--	3.89
Plastering Materials			
Cement plaster, sand aggregate	116	0.20	--
Gypsum plaster			
Lightweight aggregate	45	--	0.32
Lightweight aggregate	45	--	0.39
Same, on metal lath	--	--	0.47
Perlite aggregate	45	0.67	--
Sand aggregate	105	0.18	--
Same, on metal lath	--	--	0.10
Same, on wood lath	--	--	0.40
Vermiculite aggregate	45	0.59	--
Roofing materials			
Asbestos-cement shingles	120	--	0.21
Asphalt roll roofing	70	--	0.15
Built-up roofing	70	--	0.44
Slate roofing	--	--	0.05
Wood shingles	--	--	0.94

TABLE III. R-Factors of building materials. (Cont.)

Material and Description	Density (lb/ft ³)	R-Value	
		per inch thickness	for listed thickness
Built-up roofing	--	--	0.33
Siding materials			
Shingles			
Asbestos-cement	120	--	0.21
Wood, 16-inch with 7-1/2-inch exposure	--	--	0.80
Wood, double 16-inch width with 12-inch exposure	--	--	1.19
Wood, plus insulating backer board 6/16-inch	--	--	1.40
Siding			
Asbestos-cement lapped 1/4-inch	--	--	0.21
Asphalt roof siding	--	--	0.15
Asphalt insulating siding 1/2-inch	--	--	1.46
Wood, drop (1-inch X 8-inch)	--	--	0.79
Wood, drop (1/2-inch X 8-inch lapped)	--	--	0.81
Wood, bevel (3/4-inch X 10-inch lapped)	--	--	1.05
Plywood, lapped 3/8-inch	--	--	0.59
Plywood 1/4-inch	--	--	0.31
3/8-inch	--	--	0.47
1/2-inch	--	--	0.62
5/8-inch	--	--	0.78
3/4-inch	--	--	0.94
Stucco	116	0.20	--
Sheathing, insulating board 1/2-inch (regular density) 25/32-inch	--	--	1.32
--	--	--	2.04
Woods			
Hardwoods (maple, oak)	45	0.91	--
Softwoods (fir, pine)	32	1.25	--
25/32-inch	32	--	0.98
1-5/8-inch	32	--	2.03
2-5/8-inch	32	--	3.28
3-5/8-inch	32	--	4.55
Particle board			
Low density, 37 lb/ft ³ 1-inch	--	--	1.85
Medium density, 50 lb/ft ³ 1-inch	--	--	1.06
High density, 62.5 lb/ft ³ 1-inch	--	--	0.85
Wood doors, solid core 1-inch	--	--	1.56
1-1/4-inch	--	--	1.82
1-1/2-inch	--	--	2.04
2-inch	--	--	2.33
[*]Weights of blocks approximately 7-5/8-inch high by 15-3/8-inch long.			
[**]Vermiculite, perlite, or mineral wool insulation.			

TABLE IV. R-values of air films and air spaces.

Type and Orientation of Air Film	Direction of Heat Flow	R-value for Air Film on:			
		Non-reflective surface	Fairly reflective surface	Highly reflective surface	
Still air:					
Horizontal	up	0.61	1.10	1.32	
Horizontal	down	0.92	2.70	4.55	
45deg. slope	up	0.62	1.14	1.37	
45deg. slope	down	0.76	1.67	2.22	
Vertical	across	0.68	1.35	1.70	
Moving air:					
15 mph wind	any[*]	0.17	--	--	
7.5 mph wind	any[**]	0.25	--	--	
Orientation & Thickness of Air Space	Direction of Heat Flow	R-value for Air Space Facing:			
		Non-reflective surface	Fairly reflective surface	Highly reflective surface	
Horizontal	1/4"	up[*]	0.87	1.71	2.23
	4"		0.94	1.99	2.73
	3/4"	up[**]	0.76	1.63	2.26
	4"		0.80	1.87	2.75
	3/4"	down[*]	1.02	2.39	3.55
	1-1/2"		1.14	3.21	5.74
	4"		1.23	4.02	8.94
	3/4"	down[**]	0.84	2.08	3.25
	1-1/2"		0.93	2.76	5.24
	4"		0.99	3.38	8.03
45deg. slope	3/4"	up[*]	0.94	2.02	2.78
	4"		0.96	2.13	3.00
	3/4"	up[**]	0.81	1.90	2.81
	4"		0.82	1.98	3.00
	3/4"	down[*]	1.02	2.40	3.57
	4"		1.08	2.75	4.41
	3/4"	down[**]	0.84	2.09	3.34
	4"		0.90	2.50	4.36
Vertical	3/4"	across[*]	1.01	2.36	3.48
	4"		1.01	2.34	3.45
	3/4"	across[**]	0.84	2.10	3.28
	4"		0.91	2.16	3.44
One side of the air space is a non-reflective surface.					
[*]Winter conditions.					
[**]Summer conditions.					

A more accurate and general approach for multi-zone structures involves calculating the NLC separately for each control zone in the structure. In order to implement this approach, the user must apply Worksheet 2 for each control zone, bearing in mind the following differences in interpretation:

- a. Floors, ceilings, or walls that separate one control zone from another should be excluded from the summation of terms that contribute to the NLC. This procedure is equivalent to assuming there is no heat transfer between zones.
- b. The total perimeter of each control zone is calculated as before by taking the combined length of all external walls of all floors. In this case, however, the perimeter of each floor will not necessarily form a closed loop because walls that separate control zones (these walls are always internal) must be excluded.

In summary, Worksheet 2 may be used to obtain an estimate of the total NLC of any structure or, applying the above constraints, to find the component NLC of any zone in a complex structure.

5.1.2 Calculation of the EHC and the DHC. The EHC of any direct gain or radiant panel building with multiple thermal storage elements is given by:

$$\text{EHC} = \frac{45.5 \left[1 - e^{-0.22 (A_{\text{fm}}/A_{\text{fc}})} \right]}{(A_{\text{fm}}/A_{\text{fc}})}$$

$$\sum_{i=1}^N A_{\text{fi}} \left[\text{multiplied by} \right] s_{\text{fi}} \left[\text{multiplied by} \right] EF_{\text{fi}} \quad (\text{Equation 5.2})$$

where the indicated summation is taken over the N thermal storage elements. The total mass surface area (A_{fm}) equals the sum of the individual surface areas (A_{fi}) of the mass elements in the building, or:

$$A_{\text{fm}} = \sum_{i=1}^N A_{\text{fi}} \quad (\text{Equation 5.3})$$

The quantity s_{fi} in equation 5.2 is a heat capacity scale factor that is related to the material properties of element i through the relation:

$$s_{\text{fi}} = 1.95 \left[\text{SQRT} [\rho]_{\text{fi}} c_{\text{fi}} \right] \quad (\text{Equation 5.4})$$

where $[\rho]_{\text{fi}}$ and c_{fi} are the density and specific heat, respectively, of the material in element i. The quantity EF_{fi} is the EHC thickness function for element i and is plotted as a function of x, the dimensionless thickness in figure 25. The dimensionless thickness of element i is:

$$x_{\text{fi}} = 0.362 \left[\text{multiplied by} \right] l_{\text{fi}} \left[\text{multiplied by} \right] \left[\text{SQRT} [\rho]_{\text{fi}} c_{\text{fi}} / k_{\text{fi}} \right] \quad (\text{Equation 5.5})$$

where l_{fi} is the thickness, in feet, of element i and k_{fi} is its thermal conductivity. In order to determine the EHC of a building, calculate x_{fi} for each element and determine the associated values of EF_{fi} from figure 25. Then, multiply each thickness function by the heat capacity scale factor (s_{fi}) and the mass area (A_{fi}) and sum the results. Then, substitute the summation into equation 5.2. Mass elements not located in direct gain zones should be included in the EHC calculation if the zones are convectively coupled to the solar rooms. However, convectively coupled mass is not as effective as radiatively coupled mass. Therefore, the thickness function for convectively coupled mass elements should be multiplied by 0.4 before summing with the other contributions.

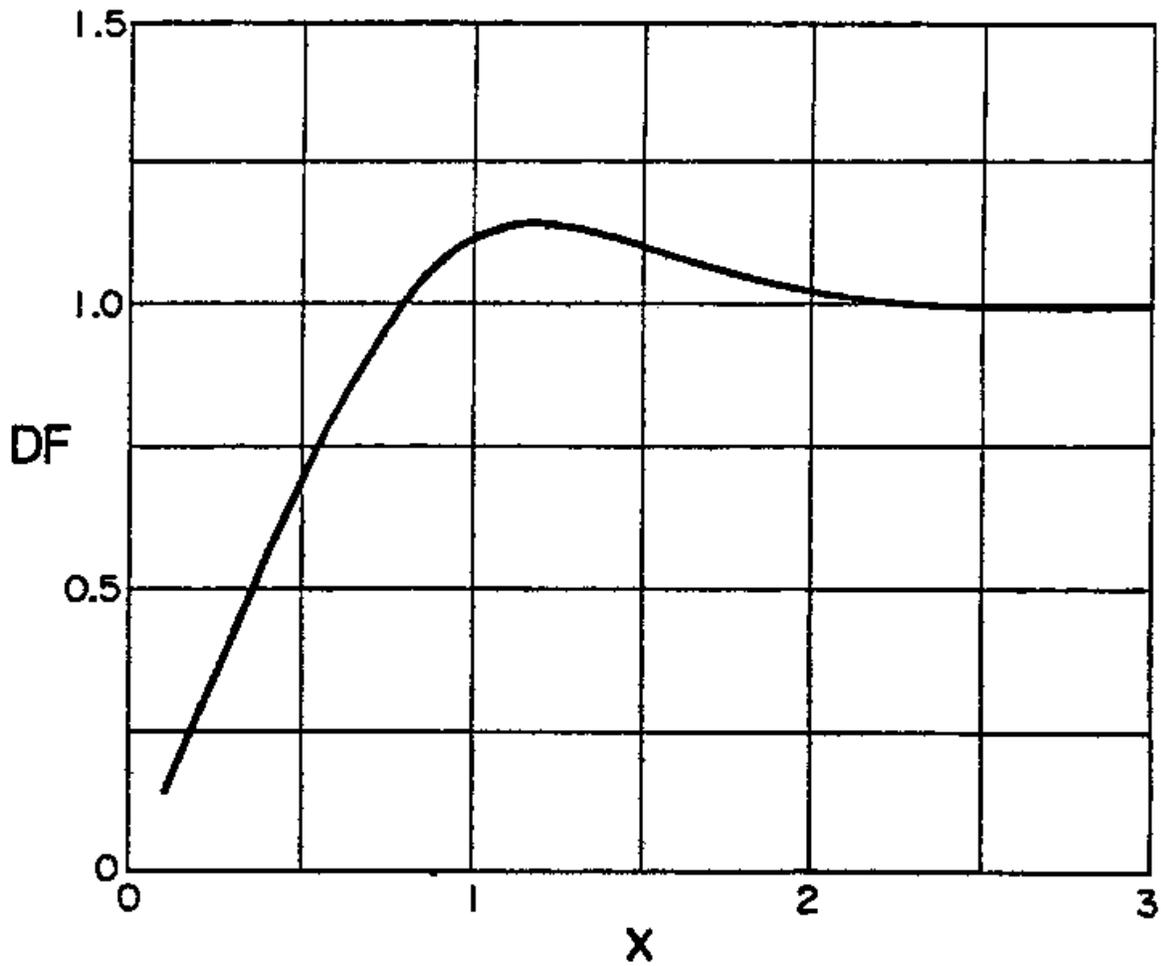


FIGURE 26. The DHC thickness function (DF) vs x.

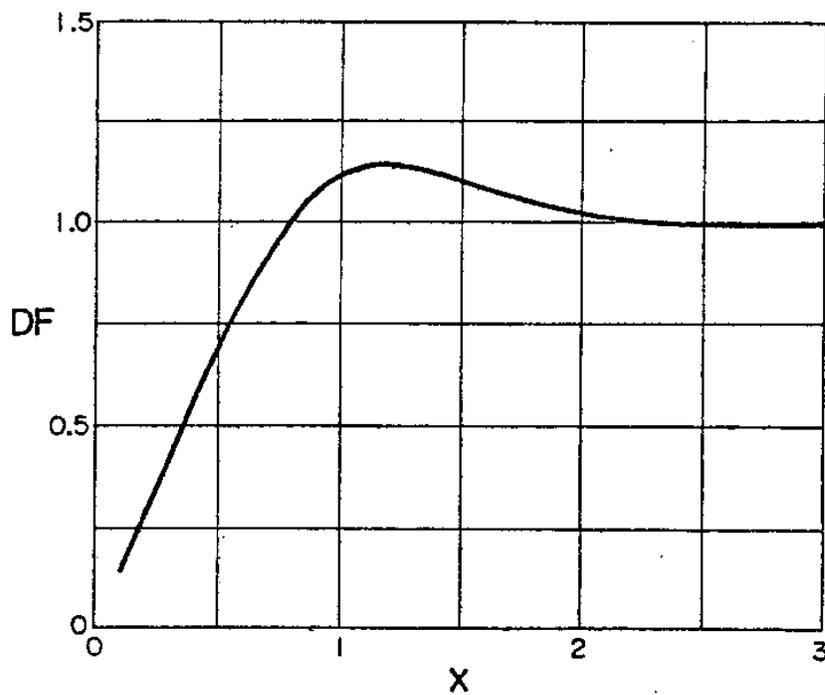


FIGURE 26. The DHC thickness function (DF) vs x.

It is usually not necessary to account for the heat storage contribution of all surfaces in a direct gain zone. Frequently, the thermal storage effect is dominated by one or two relatively thick layers of high density masonry material. A wooden frame structure on a concrete floor slab, for example, can be accurately modeled by including only the concrete slab in the EHC calculation. For the special case in which one thermal storage element dominates the building response, the EHC given by equation 5.2 reduces to:

$$\text{EHC} = 45.5 [1 - e^{-0.22 (A_{\Gamma m} / A_{\Gamma C})}] \text{ [multiplied by] } s \text{ [multiplied by] } EF \quad (\text{Equation 5.6})$$

The diurnal heat capacity of a building is given by:

$$\text{DHC} = \sum_{i=1}^N A_{\Gamma i} \text{ [multiplied by] } s_{\Gamma i} \text{ [multiplied by] } DF_{\Gamma i} \quad (\text{Equation 5.7})$$

where, again, the summation is carried out over the N thermal storage elements in the building. The quantity $DF_{\Gamma i}$ is the DHC thickness function and is plotted as a function of x in figure 26. When the DHC is used to determine the time constant of a particular building or set of rooms comprising a single thermal zone, all massive elements contained in the zone, whether in a solar room or not, should be included in the summation. In applications that involve determination of temperature swings in solar rooms, all elements that are radiatively coupled to the solar source (as in rooms having direct gain apertures or radiant panels) should be included in the summation; contributions from mass elements that are convectively coupled to the solar source are included in the summation only after multiplying their DHC thickness functions by 0.4. If only one radiating coupled mass element is contained in the thermal zone of interest, the DHC given by equation 5.7 reduces to:

$$\text{DHC} = A_{\Gamma m} \text{ [multiplied by] } s \text{ [multiplied by] } DF \quad (\text{Equation 5.8})$$

5.1.3 System parameters. Tables of system parameters for a large set of reference designs are presented in Appendix A. The reference designs include direct gain buildings, radiant panels, thermosiphoning air panels, unvented Trombe walls, vented Trombe walls, water walls, concrete block walls, and sunspaces. The system parameters include the scale factor (F), the effective aperture conductance (G), the steady state aperture conductance ($U_{\Gamma C}$) and the effective aperture absorptance ($[\alpha]$). For those systems with interior mass, $\text{DHC}/A_{\Gamma C}$ is included and, for direct gain buildings and radiant panels, $\text{EHC}/A_{\Gamma C}$ is also specified. The user must select the reference design that most closely resembles his own and use the associated parameters from Appendix A in the subsequent design analysis.

The characteristics of the reference designs will be discussed by system type in the subsections that follow. However, some of the design characteristics are common to all systems and these common properties are listed in table V.

5.1.3.1 Direct gain buildings. A set of 81 reference direct gain designs are included in Appendix A. The 81 designs were selected by choosing three appropriate values for each of the four principal design variables and

allowing all possible combinations of those variables (Note: $3 \times 3 \times 3 \times 3 = 81$ combinations). The principal design variables and associated values are:

$$A_{Tm} / A_{Tc} = 3, 6, 9$$

$$\text{THICK} = 2, 4, 6 \text{ (inches)}$$

$$\text{R-value} = 0, 4, 9 \text{ (deg.F-ft}^2\text{-hr/Btu)}$$

$$\text{NGL} = 1, 2, 3$$

where A_{Tm} / A_{Tc} is the ratio of the thermal storage mass surface area to the solar collection area, THICK is the thermal storage mass thickness in inches, R-value is the thermal resistance of the solar aperture with night insulation in place, and NGL is the number of glazings in the aperture.

The thermal storage mass in the direct gain systems is high density concrete with the following properties:

density	[rho] = 150 lb/ft ³
specific heat	c = 0.2 Btu/lb-deg.F
thermal conductivity	k = 1.0 Btu/deg.F-ft ² -hr

The concrete is assigned a solar absorptance of 0.8 and an infrared emittance of 0.9. Twenty percent of the transmitted and internally reflected solar radiation is assumed to be absorbed on non-massive surfaces and rapidly convected to the room air.

Properties of other building materials that can provide thermal storage are listed in table VI. Any of these other materials can be substituted for the concrete in the reference designs. The procedure is to simply select the reference design that has an EHC closest to the design under consideration and the same NGL and R-value. It is not necessary to match the parameters THICK or A_{Tm} / A_{Tc} . If the contemplated design does not have an EHC close to one of the reference values, linear interpolation may be employed on the values of F and G.

If interpolation on the EHC is used to determine F and G, then U_{Tc} is read from either of the reference designs involved in the interpolation. (The values of U_{Tc} will be identical because both systems involved must have the desired NGL and R-value.) The best estimate of [alpha] is obtained from the reference design having the desired NGL and an A_{Tm} / A_{Tc} ratio closest to the design under consideration.

The effect on performance of decorative coverings placed over mass surfaces is included in the analysis by multiplying the EHC by the factor:

$$[\alpha] / (1.31 [\text{multiplied by}] R_{Tc} + 0.8) , \quad (\text{Equation 5.9})$$

where R_{Tc} is the thermal resistance or R-value of the decorative covering and [alpha] is the solar absorptance of its surface; this factor was derived on the basis of steady state energy balance research reported in the ASHRAE Journal.

TABLE V. Reference design characteristics.

<u>Glazing Properties</u>	
Transmission characteristics	diffuse
Orientation	south
Index of refraction	1.526
Extinction coefficient	0.5 in. ⁻¹
Thickness of each pane	1/8 in.
Air gap between panes	1/2 in.
<u>Thermal Control</u>	
Room temperature	65deg.F to 75deg.F
Internal heat generation	none
<u>Night Insulation</u>	
Thermal resistance	R-4 or R-9
In place, solar time	5:30 p.m. to 7:30 a.m.
<u>Solar Radiation Assumptions</u>	
Shading	none
Ground diffuse reflectance	0.3

TABLE VI. Properties of building materials (from ASHRAE Handbook and Product Directory, 1977 Fundamentals).

Material	Density, [ρ] lb/ft ³	Specific Heat, c (Btu/lb-deg.F)	Thermal conductivity, k (Btu/deg.F-ft-hr)	[r
Magnesite Brick	158	0.22	2.20	76
Marble	162	0.21	1.50	51
Concrete (high density reference)	150	0.20	1.00	30
Plaster	132	0.43	0.42	23
Chrome brick	200	0.17	0.67	22
Fireclay brick	112	0.20	0.58	13
Concrete (stone)	144	0.16	0.54	12
Concrete (lightweight aggregate)	120	0.21	0.43	10
Brick, building	123	0.20	0.40	9
Adobe			0.38	6
Sand	95	0.19	0.19	3
Gypsum board	50	0.26	0.10	1

[*]Private communication from J. C. Hedstrom, Los Alamos National Laboratory. Adobe absorbs moisture readily, and properities can vary widely with moisture content. The thermal conductivity is particularly sensitive.

If multiple storage elements are present, the appropriate correction factor must be applied to each element individually. R-values for finish materials are included in table III and solar absorptances are available in table VII which, though not specifically directed at finish materials, does indicate the variation of α with color. For convectively coupled mass elements, set α equal to 0.8, the reference design value, regardless of surface color.

5.1.3.2 Radiant panels. Three reference designs are available for simple radiant panels. Double glazing is used in all cases. The distance between the inner glazing and the metal absorber plate is 1-inch and the plate has a solar absorptance of 0.95 and an infrared emittance of 0.9. The thermal storage medium is high density concrete. The concrete thickness is 4 inches and the area ratio may be 3, 6, or 9. System parameters, including the EHC are provided in Appendix A. Systems may be analyzed with other thermal storage materials or configurations by employing the EHC as described in 5.1.3.1. For radiant panels, however, the α in equation 5.4 is the infrared absorptance (α_{ir}) rather than the solar absorptance. Therefore, to correct for the presence of decorative coverings, use the formula:

$$\alpha_{ir} / (1.48 [multiplied\ by] R_{cd} + 0.9) \quad (\text{Equation 5.10})$$

The infrared absorptance of most building or finish materials is about 0.9.

5.1.3.3 Thermosiphoning air panels. There are 18 reference designs for TAP systems that include both single and double glazed apertures. The solar absorptance of the metal panel is 0.95 and the infrared emittance is 0.9. The thermal storage medium is high density concrete and all combinations of 2, 4, and 6 inch thicknesses with A_{fm}/A_{fc} ratios of 3, 6, and 9 are available. The flow channel depth is 3.5 inches and, for the backflow systems, the absorber surface is 1 inch behind the inner glazing. The upper and lower vents are 8 feet apart and have a total area equal to 6 percent of the panel area.

The R-value of insulation between the back of the flow channel and the room air (RTAP) is R-11. If any other value is desired for RTAP, one has only to calculate the effective aperture conductance and the steady state aperture conductance from the following equations:

$$G = 24 / [RTAP + K_{fb} + (NGL - 1) + 3.7] \quad (\text{Equation 5.11})$$

$$U_{fc} = G/24 \quad (\text{Equation 5.12})$$

where K_{fb} is a parameter whose value is one for a backflow system and zero otherwise. The scale factor (F) does not vary with RTAP or K_{fb} but is dependent on NGL. Note that the correlations presented in Appendix A are for frontflow systems with RTAP = 11. For backflow systems, $e_{cd} = 0.58$ for single glazed systems and $e_{cd} = 0.69$ for double glazed systems.

5.1.3.4 Trombe walls. The Trombe wall reference designs are split into two subcategories: vented and unvented. For both subcategories, the parameters that are varied among the Trombe wall reference designs are the thermal storage capacity (expressed also in terms of wall thicknesses varying from 6 to 18 inches), the number of glazings (1, 2, or 3), the wall surface (flat black or selective), night insulation (none or R-9), and the masonry

TABLE VII. Solar absorptance of various materials.*

Material	Solar Absorptance
Flat black paint	0.95
Black lacquer	0.92
Dark gray paint	0.91
Black concrete	0.91
Dark blue lacquer	0,91
Black oil paint	0.90
Stafford blue bricks	0.89
Dark olive drab paint	0.89
Dark brown paint	0.88
Dark blue-gray paint	0.88
Azure blue or dark green lacquer	0.88
Brown concrete	0.85
Medium brown paint	0.84
Medium light brown paint	
Brown or green lacquer	0.79
Medium rust paint	0.78
Light gray oil paint	0.75
Red oil paint	0.74
Red bricks	0.70
Uncolored concrete	0.65
Moderately light buff bricks	0.60
Medium dull green paint	0.59
Medium orange paint	0.58
Medium yellow paint	0.58
Medium blue paint	0.51
Medium Kelly green paint	0.51
Light green paint	0.47
White semi-gloss paint	0.30
White gloss paint	0.25
Silver paint	0.25
White lacquer	0.21

*This table is meant to serve as a guide only. Variations in texture, tone, overcoats, pigments, etc., can vary these values.

properties (ρ ck products of 7.5, 15, or 30, where 30 corresponds to the high density concrete used in the reference designs of other system types). The 21 combinations of these parameters used for both the vented and unvented Trombe wall reference designs are presented in Appendix A.

Certain characteristics of the Trombe wall reference designs are fixed. These fixed characteristics are listed in table VIII.

TABLE VIII. Trombe wall reference design characteristics.

<u>Optical Properties</u>	
Solar absorptance of wall surface (black)	0.95
Solar absorptance of selective surface	0.90
Infrared emittance of wall surface	0.90
Infrared emittance of selective surface	0.10
<u>Thermocirculation vents</u>	
Total vent area (percent of wall area)	6
Vertical separation of vents (feet)	8

5.1.3.5 Water walls. The parameters varied in the water wall reference designs are the thermal storage capacity or wall thickness (3, 6, 9, 12, 18, or 24 inches), the number of glazings (1, 2, or 3), the optical properties of the wall surface (flat black or selective), and the night insulation (none or R-9). The optical properties for the flat black and selective surface walls are the same as those specified for Trombe walls in table VIII. system parameters for fifteen reference designs are presented in Appendix A.

5.1.3.6 Concrete block walls. Eight reference designs for unvented thermal storage walls constructed of 8-inch x 8-inch x 16-inch concrete building blocks are provided in Appendix A. The concrete blocks used to develop the correlations weighed about 25 pounds each and had two hollow rectangular cores. The eight reference designs include single and double glazed systems with and without mortar filling in the cores; the systems may employ R-9 night insulation or none. The optical properties of the surface are the same as for a flat black Trombe wall as specified in table VIII.

The concrete block wall reference designs include secondary thermal storage mass in the floor. The floor is 4-inch thick high density concrete and has an area three times the size of the glazed block wall. The massive floor was included in the reference designs to more realistically represent typical concrete block building construction.

5.1.3.7 Sunspaces. The principal sunspace glazing is assumed to face due south. Thus, wall locations are referred to by the compass directions: the principal glazing is the south wall, the principal common wall is the north wall, and the end walls are the east and west walls.

Two types of sunspaces are defined according to the degree of integration with the rest of the building. One type is the attached sunspace, whose north wall is common with adjoining rooms and 30-foot wide in the east-west direction. The other type is the semi-enclosed sunspace that has three common walls, the north, the east, and the west. The semi-enclosed sunspaces are 24-foot wide (east-west) and 12-foot deep (north-south). The north common wall is 9-foot high in all reference designs.

One geometrical shape of the attached sunspace and two of the semi-enclosed sunspace are treated. The attached sunspace has a single plane of glazing on the south wall, tilted up from the horizontal by 50 degrees. The two semi-enclosed geometries are: (1) a single, vertical plane of glazing on the south wall, and (2) a single 50-degree tilted plane of glazing on the south wall. These three geometrical configurations are illustrated in figure 27.

The reference designs include two types of common wall between the sunspace and the adjacent building. One is lightweight and insulated, corresponding to a frame wall with a thermal resistance of R-20; and one is uninsulated 12-inch thick high density concrete as used in the direct gain designs. In the lightweight wall configuration, there is a row of water containers in the sunspace for thermal storage. The row extends the full east-west width of the sunspace. The containers are twice as high as they are deep. The water volume is $1 \text{ ft}^3 / \text{ft}^2$ of common wall area. The containers are on the sunspace floor immediately adjacent to the common wall and are thermally coupled to the wall and floor by radiation and convection through the sunspace air.

Both wall configurations include thermocirculation vents in the common wall whose areas total 6 percent of the north wall area. The vent centers are separated by a height of 8 feet. There is no reverse thermocirculation.

For each geometry and wall configuration, movable insulation may or may not be applied at night to the sunspace glazing. When used, the night insulation has a thermal resistance of R-9 and is in place from 5:30 p.m. to 7:30 p.m. solar time. The end walls of the sunspace are insulated to R-20 and have no glazing.

The sunspace floor is a 6-inch thick slab of masonry material with a thermal conductivity of 0.5 Btu/deg.F-ft-hr and a volumetric heat capacity of 30 Btu/ft³. There is conduction through underlying soil to a fixed temperature deep in the earth and through perimeter insulation to the ambient air.

The surfaces of the common wall on the sunspace side have solar absorptance of 0.7 if they are lightweight and 0.8 if they are masonry. The water containers have a solar absorptance of 0.9. The sunspace floor has a solar absorptance of 0.8. The other surfaces (ceiling and end walls) have solar absorptance of 0.3.

A sunspace infiltration rate of 0.5 air changes per hour is assumed in all reference designs. Auxiliary heating prevents the sunspace temperature from falling below 45deg.F and ventilation is assumed to limit the maximum sunspace temperature to 95deg.F if possible.

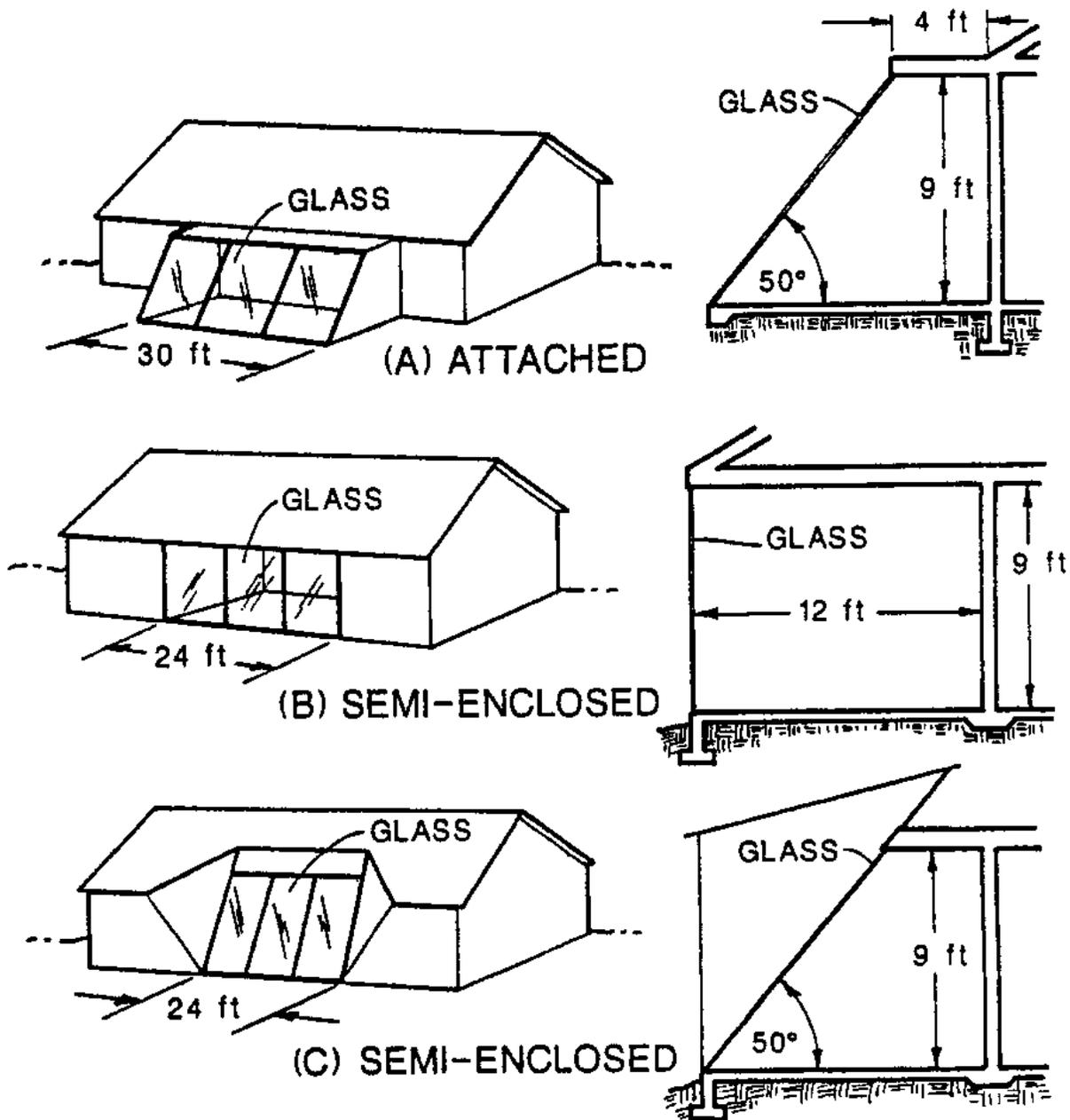


FIGURE 27. Sunspace geometries (not to scale).

The system parameters F , G , $U_{\Gamma C_1}$, and $[\alpha]$ are listed in Appendix A for 16 reference sunspace designs. Minor variations from the geometry, optical properties, and insulation R-values specified in the preceding paragraphs will not greatly effect system performance. To maintain high performance use plenty of thermal storage mass with a high solar absorptance, light colors on lightweight surfaces, and high R-values on east and west walls and on insulated common walls. The effect of sunspace glazing tilt may be included in the performance analysis process as will be described later. Remember that sunspace analysis is conducted in terms of the projected area of the solar aperture ($A_{\Gamma p_1}$) rather than the actual area.

5.1.4 System parameter worksheet. Worksheet 3 is provided to help keep track of the various system parameters that must be calculated or obtained from Appendix A. Note that the worksheet allows for the presence of two passive solar heating systems on a building and provides formulas for calculating the properties of the resulting mixed system.

The first step in filling out the worksheet is to calculate the thermal storage characteristics of the building. For direct gain or radiant panel systems, the EHC must be determined. If the thermal storage mass properties and configuration correspond closely to one of the reference designs in Appendix A, simply enter the specified EHC/A_{FC} in the indicated blank on the worksheet; the diurnal heat capacity per ft² of aperture, DHC/A_{FC}, is then found from the same reference design. Otherwise, it will be necessary to calculate the EHC and the DHC as described in 5.1.2 and to evaluate DHC/A_{FC} as outlined below.

Among the remaining reference designs, only TAPS and concrete block Trombe walls have specified levels of interior mass. For the concrete block Trombe walls, the interior mass provides secondary thermal storage to the wall itself and only one representative level is treated (high density concrete with a thickness of 4 inches and a surface area three times greater than the block wall area). The TAP reference designs have the same interior mass options available for direct gain systems. The DHCs for concrete block walls and TAPs are specified in Appendix A for the reference designs.

After entering values of the EHC/A_{FC} and DHC/A_{FC} on Worksheet 3, proceed to the first (or only) set of system parameters. Enter the system type and number (from Appendix A). If interpolation on the EHC has been employed, enter the numbers of both systems involved. Then enter the first set of system parameters on the worksheet. Finally, enter the size of the first solar collection aperture (using projected area for sunspaces).

If two types of passive solar systems are present on the building, proceed to the next part of the worksheet and enter a second set of parameters. Next, calculate the area fractions of the two systems and use the formulas provided on the worksheet to calculate the parameters for the mixture.

5.1.5 Effective thermostat setpoint. Auxiliary heat consumption can often be reduced significantly by setting back the thermostat at night. In order to include this strategy in our design analysis calculations, it is necessary to determine the effective thermostat setpoint, T_{fe}, for use in the base temperature calculation.

The first step is to calculate the average thermostat setting from the following equation:

$$T_{\text{ave}} = T_{f1} (hr_{f1}/P) + T_{f2} (hr_{f2}/P) \quad (\text{Equation 5.13})$$

where T_{f1} and hr_{f1} are the temperature and duration (in hours) of the first setting, T_{f2} and hr_{f2} are the temperature and duration of the second setting, and P is the period of the diurnal cycle (24 hours).

Next, determine the building time constant given by:

$$[\tau] = 24 \left[\text{multiplied by} \right] \text{DHC} / \left(\text{NLC} + 24 \left[\text{multiplied by} \right] U_{FC} \right) \left[\text{multiplied by} \right] A_{FC} \quad (\text{Equation 5.14})$$

All parameters in this equation are available from the first three worksheets.

Finally, the effective thermostat setpoint is obtained from the relation:

$$T_{Fe} = T_{Fl} - e^{-0.1[\tau]/P} (T_{Fl} - T_{ave}) \quad (\text{Equation 5.15})$$

Use T_{Fe} in place of T_{Fset} whenever a night time setback strategy is employed.

5.1.6 Base temperature worksheet. Worksheet 4 is provided to help the user determine the base temperature for either a constant thermostat setting or for a night time setback strategy as outlined in the preceding section. All of the equations needed are provided on the worksheet. Remember that Q_{int} is the internal heat generation rate in Btu/day by people, lights, and appliances. Unless other information is available, use $Q_{int} = 20,000$ Btu/day per occupant.

5.1.7 Weather parameters. Having recorded the NLC on Worksheet 2, the system parameters (F , G , U_{FC} , and $[\alpha]$) on Worksheet 3, and the base temperature on Worksheet 4, evaluate the weather parameters that are needed for design analysis of passive solar heating systems. The required parameters are the transmitted radiation to degree day ratio (VTn/DD) and the city parameter (a). These quantities are tabulated for 210 cities in the continental United States in Appendix B. Provision is made for obtaining parameter values for single, double, or triple glazed systems operating at base temperatures ranging from 30deg.F to 80deg.F. The solar aperture may depart from true south by 60 degrees to the east or west and may be tilted 60 degrees from the vertical. Use of the tables in Appendix B is discussed in the following subsections.

5.1.7.1 Transmitted radiation to degree day ratio. First, locate the city of interest in Appendix B. The locations are alphabetized, first by state and second by city within each state. Next, locate the column with the appropriate value of the base temperature T_{fb} . Base temperatures ranging from 30deg.F to 80deg.F are provided; interpolation may be required. Having located the correct column, read and record the value from the row labeled $VT1/DD$, $VT2/DD$, or $VT3/DD$, depending on whether the system of interest is single, double, or triple glazed. (Note: The minimum monthly value of VTn/DD is tabulated in these columns and the reference month (m) is indicated in parentheses.) If the symbol NA (not applicable) appears, it is an indication that, for the specified base temperature, solar heating is not required.

5.1.7.2 City parameter. The city parameter (a) is obtained from the same column in which VTn/DD was found; again, interpolation may be required. The number is read from the row marked "PARAMETER A" under the reading "SOUTH-VERT". The adjustment required for off-south or tilted apertures is discussed next.

5.1.7.3 Off-south or tilted apertures. If the orientation of the solar aperture is not due south and vertical, the weather parameters must be corrected according to the following equations:

$$a = a_{\text{south}} [1 + A1([\theta]/100) + A2([\theta]/100)^2 + A3([\theta]/100)^2([\psi]/100) + A4([\psi]/100) + A5([\psi]/100)^2] \quad , \quad (\text{Equation 5.16})$$

$$VTn/DD = (VTn/DD)_{\text{south}} [1 + B1([\theta]/100) + B2([\theta]/100)^2 + B3([\theta]/100)^2([\psi]/100) + B4([\psi]/100) + B5([\psi]/100)^2] \quad , \quad (\text{Equation 5.17})$$

where a_{south} and $(VTn/DD)_{\text{south}}$ are the south-vertical values. The coefficients, A1 through A5 and B1 through B5, are obtained from labeled rows in the weather tables in the column having the desired base temperature. Interpolation between two base temperatures may be necessary. The angle $[\theta]$ is the azimuth of a normal to the aperture with due south taken as zero and east as positive. The angle $[\psi]$ is the tilt of the aperture relative to a vertical position, i.e., $[\psi]$ is zero for a vertical aperture. Equations 5.11 and 5.12 are applicable to azimuths of up to +/-60 degrees and tilts of up to 60 degrees.

5.1.8 Weather parameter worksheet. Worksheet 5 is provided to guide the user through the process of obtaining and recording weather data needed for design analysis. The first part of the worksheet calls for data about the building location and the annual heating degree days. The next two parts are parallel and provided a step by step procedure for calculating the weather parameters needed for each of two separate passive solar heating systems that may serve the building. If only one system is present, make only one set of entries on the worksheet. Also, if two systems that have the same number of glazings, the same orientation, and the same tilt are present, only one set of entries on the worksheet is required.

Finally, the last part of the worksheet provides equations for calculating the mixed system weather parameters in the event two non-similar systems are present. Record the results of these calculations in the indicated blanks.

5.1.9 Auxiliary heat consumption worksheet. Determination of the auxiliary heat requirements is outlined on Worksheet 6. First, the scaled solar load ratio of the system is calculated on the basis of parameters previously recorded on Worksheets 2, 3, 4, and 5. The annual heat to load ratio is read off the nomograph in figure 23 using the calculated value of the scaled solar load ratio and the city parameter recorded on Worksheet 5. Finally, the auxiliary heat required annually is obtained by multiplying the heat to load ratio by the annual building load. Worksheet 6 guides the user through the calculation and provides a written record of performance analysis results.

5.2 Design refinement. The discussion presented in the following subsections advises the user on how to modify the design just analyzed on the worksheets if the results obtained were not satisfactory.

5.2.1 System economics. The ratio of annual energy saved to capital invested (E/C), in MMBtu/K\$, is a useful economic parameter. The annual energy saved is given by:

$$E = Q_{rN} - Q_{rA} \quad , \quad (\text{Equation 5.18})$$

where Q_{rA} is the annual auxiliary heat requirement from Worksheet 6 and Q_{rN} is the net annual load. The formula for net annual load is:

$$Q_{rN} = \text{NLC} [\text{multiplied by}] \text{DD}_{ra} \quad , \quad (\text{Equation 5.19})$$

where NLC is the net load coefficient from Worksheet 2 and DD_{ra} is the annual heating degree days from Worksheet 5. Note that aperture losses are not included in equation 5.19 so that the passive heating system is not inappropriately credited with saving energy by meeting its own load.

The capital invested (C) is the total cost of the passive solar heating system. The heating system cost depends on the design and on location dependent costs for materials and construction. This parameter must be estimated by the user.

Clearly, the E/C ratio can be increased by reducing the auxiliary heat requirement and/or the system cost. Guidance for improving solar heating performance is provided in the following section on system efficiency.

5.2.2 System efficiencies.

5.2.2.1 System efficiency worksheet for reference month. Worksheet 7 is provided for calculation of the system efficiencies during the reference month (m) noted beneath the base temperature in the weather tables. The reference month is the harshest month in the heating season, for a particular base temperature, in that the associated value of V_{Tn}/DD is a minimum.

In the first part of the worksheet, equations and blanks are provided for calculating and recording the values of the effective total load coefficient (TLC_{re}) and the solar heating fraction (SHF). These two quantities are then substituted into the equation for e_{rt} that follows.

The second part of the worksheet merely provides a blank for recording the value of the delivery efficiency (e_{rd}) that is tabulated for all systems in Appendix B.

In the final part of the worksheet, the utilization efficiency (e_{ru}) is calculated from the indicated formula.

5.2.2.2 Improving total system efficiency. It is convenient to think in terms of improving the total system efficiency by increasing the magnitude of its factors, e_{rd} and e_{ru} .

The delivery efficiency is defined as the fraction of the solar heat absorbed by the system that is actually delivered to the living space. For direct gain systems, this quantity is always unity because the living space is the absorber. For other systems, e_{FD} is always less than 1 and can be increased by adding additional layers of glazing or employing a selective surface. Both of these strategies decrease heat losses from the absorber surface to ambient conditions. The delivery efficiency could also be increased by decreasing the thickness of thermal storage walls. This strategy, however, is not advisable because it can result in an offsetting decrease in e_{FD} .

The utilization efficiency is the fraction of the heat delivered to the building interior that is used to meet the building heat load. The un-utilized heat must be ventilated to avoid overheating the living space. The utilization efficiency therefore provides a useful measure of thermal comfort and convenience. Systems having values of e_{FD} below 0.6 should be avoided and values of 0.7 and above are advisable. The principal strategy for increasing e_{FD} is to add more thermal storage mass. Thus, thermal storage wall thickness may be increased and additional mass layers may be added to direct gain or radiant panel buildings. In fact, the addition of interior mass can be used to improve the utilization efficiency of any passive heating system although the effect can presently be quantified only for direct gain or radiant panel buildings.

A low utilization efficiency can also indicate that the solar aperture is too large. If the annual heat to load ratio is fairly small, for example 0.2 or less, and the utilization efficiency is below 0.6, the aperture size should be reduced. An excessively large aperture may yield good performance in terms of energy savings, as indicated by low values of $(Q_{FA}/Q_{FL})_{FA}$, but may be uncomfortable and inconvenient as indicated by low values of e_{FD} .

5.2.3 Worksheet for average maximum temperature during reference month. A step by step procedure for estimating the average maximum room temperature (assuming no heat is ventilated) during the reference month is presented in Worksheet 8. The first step is to calculate Q_{FD} , the solar energy delivered to the living space. As specified on the worksheet, Q_{FD} is the product of $[\alpha]$ and A_{FC} (Worksheet 3), e_{FD} (Worksheet 7), VT_{m}/DD (Worksheet 5), and DD , the heating degree days for the reference month. Values of DD are tabulated in Appendix B for a series of base temperatures in each included city.

The second step is to calculate the excess solar energy during the reference month. The amount of solar energy utilized is given by the product of e_{FD} and Q_{FD} , so the excess heat (Q_{FE}) is given by the product of $(1 - e_{FD})$ and Q_{FD} as indicated on the worksheet.

Next, the average room temperature (T) that would prevail in the living space, if excess solar heat were ventilated, is calculated from the empirical equation given on Worksheet 8; the solar heating fraction (SHF) is available on Worksheet 7. The temperature increment without ventilation ($[W-DELTA]T_{FI}$) is then calculated by dividing the excess solar energy by the number of days in the reference month and the DHC of the building. The average maximum temperature in the living space without ventilation (T_{Fmax}) is then obtained by summing T and $[W-DELTA]T_{FI}$.

High values of $\overline{T_{rmax}}$ indicate that the building is a poor design and may overheat badly causing discomfort to the occupants. Inspection of the equations on Worksheet 8 indicates that $\overline{T_{rmax}}$ may be reduced by:

- a. Reducing the solar collection area (A_{rc}).
- b. Increasing the utilization efficiency (e_{ru}).
- c. Increasing the diurnal heat capacity (DHC).

5.2.4 Annual incremental cooling load. The annual incremental cooling load (Q_{rl}) associated with a passive solar heating system is defined here as that part of the solar energy delivered to the living space that must be removed from the building to avoid exceeding a specified maximum temperature thereby maintaining a comfortable environment. This definition includes excess heat delivered to the building during the winter months and does not account for the beneficial potential of ventilation. Furthermore, the calculation procedure presented in this section does not include the effect of such defensive countermeasures as overhangs, drapes, shades, or covers. Therefore, the incremental cooling load should be considered to be a worst case indicator that emphasizes the need to employ ventilation and shading on passive solar buildings. Also, Q_{rl} provides a basis for comparing passive solar designs in terms of their tendency to aggravate the cooling load.

5.2.4.1 Delivered solar energy worksheet. Worksheet 9 presents the steps required to calculate $(Q_{rd})_{ra}$, the total solar heat delivered to the living space during a one year period. This quantity is needed in connection with the incremental cooling load calculation.

The first step is to read the total annual transmitted solar radiation, $QTAn$, from the row marked DUE SOUTH AND VERTICAL. The number n in $QTAn$ indicates whether the system is single, double, or triple glazed. Next, read coefficients, $C1$ through $C5$, from the following row marked AZIMUTH AND TILT COEF. The transmitted radiation, corrected for azimuth and tilt, can then be calculated from the following formula:

$$\begin{aligned} QTAn = (QTAn)_{rc} [1 + C1([\theta]/100) + C2([\theta]/100)^2 \\ + C3([\theta]/100)^2 ([\psi]/100) + C4([\psi]/100) \\ + C5([\psi]/100)^2] \end{aligned} \quad (\text{Equation 5.20})$$

This quantity should be entered in the worksheet in the blank labeled $(QTAn)$. Note that mixtures of two systems are allowed and that the mixing algorithm for $(Q_{rd})_{ra}$ is provided on the worksheet.

5.2.4.2 Incremental cooling load worksheet. The incremental cooling load may be determined by following the procedure set forth on Worksheet 10. The first step is to calculate the annual heat to load ratio using a thermostat setting that is 10deg.F below the maximum temperature to be tolerated in the living space. If this setting is the same as the one previously employed in the heating analysis, no new calculations are required. Otherwise, Worksheets 4, 5, and 6 must be re-done to determine the new value of $(Q_{ra}/Q_{rl})_{ra}$.

Having determined the heat to load ratio, Q_{FA} is found as indicated on Worksheet 6, and the annual solar heating fraction, SHF_{FA} , is calculated from the equation given on Worksheet 10. Then, the annual utilization efficiency, $(e_{FU})_{FA}$, can be calculated using the indicated equation.

Next, calculate T_{act} , the actual indoor temperature (the annual average) from the equation provided on the worksheet. Use the previously determined value for $(e_{FU})_{FA}$. Then, using T_{act} in place of T_{set} , obtain a new base temperature from Worksheet 4. Enter the weather tables in the column indicated by the new base temperature and read the actual heating degree days, DD_{act} , from the row marked MONTHLY DD. Enter this quantity on the worksheet.

Finally, calculate Q_{act} , the actual annual heating load, from the equation provided on Worksheet 10, and then evaluate Q_{I} by subtracting Q_{act} from the sum of Q_{D} and Q_{FA} . Thus, the incremental cooling load is the difference between the amount of heat put into the building (solar plus auxiliary) and the amount actually lost to the outside.

5.2.4.3 Reducing the incremental cooling load. The incremental cooling load can be reduced by employing systems with higher utilization efficiencies, smaller apertures, or more thermal storage mass. During the heating season and early and late in the cooling season, ventilation can be employed to remove most of the excess heat. Overhangs can reduce delivery of unwanted solar heat to the living space as can drapes and shades in direct gain buildings. However, external shutters or covers are by far the most effective means of reducing or even eliminating the incremental cooling load.

5.3 Example calculations for a four-plex family housing unit.

5.3.1 Description of the building. In this section an example is presented that illustrates use of the schematic design guidelines in 4.3 and the design analysis procedures in 5.1 and 5.2. To illustrate the special problems associated with multizone design, a four-plex family housing unit was selected for consideration.

A sketch of the four-plex unit to be solarized is presented in figure 28. The long dimension of the structure is oriented 15 degrees east of true south, the departure presumably resulting from some constraint at the building site. Each individual two story family section has a length of 37 feet and a depth of 23 feet. The heated floorspace of each section is therefore about 1700 ft² and the total floorspace of the building is 6800 ft². In the following sections this family housing unit will be solarized as a direct gain system located in Norfolk, Virginia.

5.3.2 Schematic design parameters. Begin by filling out Worksheet 1 as illustrated in the example. Using the dimensions given in figure 28 and the formulas on the worksheet, it is an easy matter to obtain the "Building Size Parameters" and determine that the external surface area to floor area ratio is 2.91. Note that the total heated floorspace of the four-plex unit is being used in the analysis; this approach will yield the total solar aperture size and auxiliary heat requirement for the building. (An approximate procedure for partitioning the aperture area between inner and outer sections of the unit will be discussed later, as will section by section analysis.)

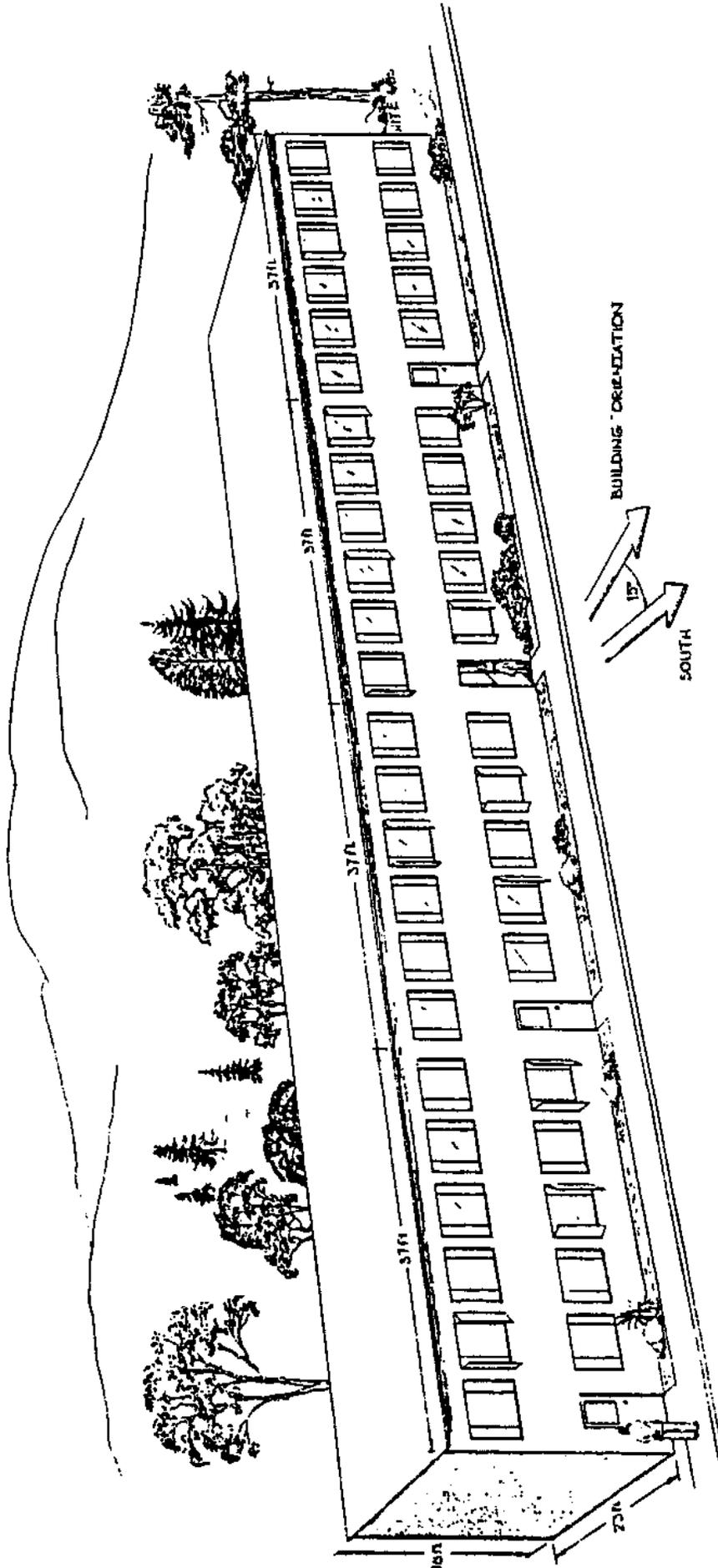


FIGURE 28. Four-plex family housing unit.

Next, select a reference value for wall insulation, R_{WALL} , from the contour map in figure 13. As Norfolk is slightly below the middle of the harsh climate range on the east coast, an R-value just below the middle of the recommended range is selected, that is, $R_{WALL} = 22$. After correcting for building size, R_{WALL} becomes 21. Values for roof and perimeter insulation are easily obtained from the scaling formulas indicated on the worksheet.

The aperture size ratio (expressed in percent of floorspace) for a reference 1500 ft² building is read from the contour map in figure 15. Selecting the maximum value for the region encompassing Norfolk, we obtain:

$$(A_{GC}/A_{GF})_{ref} = 0.12 ,$$

where the fractional value is indicated rather than the percentage value. This ratio is then scaled for building size (using the formula on the worksheet) to obtain a total solar collection area of:

$$A_{GC} = 791 \text{ ft}^2 .$$

Enter this number on the worksheet and finally, enter the azimuth of 15 degrees at the bottom.

5.3.3 Net load coefficient. A copy of Worksheet 2 is provided for the example calculation. The total external perimeter includes both floors and totals 684 feet. The ground floor area and perimeter are 3,400 ft² and 342 feet, respectively. The roof area (horizontal projection) is the same as the ground floor area and the south wall area, including windows, is 2,664 ft². A value of 0.05 is selected for the non-south window fraction and the windows are assumed to be double glazed. The infiltration rate is assumed to be 0.6 air changes per hour and the air density ratio is set at 1.0, the sea level value.

In the next part of the worksheet, the non-south window area and the wall area are calculated using the indicated equations and previously determined parameters.

Finally, in the last part of the worksheet, the various components of the net load coefficient are calculated and summed to obtain the value of $NLC = 28,248$.

5.3.4 System parameters. The next task is to record the system parameters on Worksheet 3 which is provided for this example. First, record the system type, direct gain, and then proceed to determine whether or not the thermal storage mass corresponds to a reference design. If the thermal mass does not correspond closely to a reference design it will be necessary to perform detailed calculations to determine EHC/A_{GC} and DHC/A_{GC} .

Assume that the only significant high mass elements in the building are the 4-inch thick high density concrete floor slabs, and that heat is stored in these slabs through their upper surfaces. The total surface area available for storage is therefore 6,800 ft². However, mass that is not located in rooms containing direct gain apertures is only 40 percent as effective as that in direct gain rooms; this reduced effectiveness occurs because remote mass

is convectively coupled to the solar heat source rather than radiatively coupled. If we assume that only 50 percent of the floor slab area is located in direct gain rooms, then the surface area available for storage is:

$$0.5 \times 6,800 + 0.4 \times (0.5) \times 6,800 = 4,760 \text{ ft}^2 \text{ .}$$

Dividing this number by $A_{FC} = 791 \text{ ft}^2$ from Worksheet 1 yields a mass to collector area ratio of:

$$A_{m} / A_{FC} = 6.02 \text{ .}$$

If the concrete slabs are covered with dark brown ($\alpha = 0.88$ from table VII) linoleum tile ($R_{fd} = 0.05$ from table III) the floor covering correction factor has a value of 1.01 (see equation 5.9). This correction factor is close to 1 because the thermal resistance of the tile is offset by the enhanced solar absorptance. The effective area ratio of the thermal storage mass therefore remains very nearly equal to 6, which is a reference design value.

Employing the four digit numbering system used for direct gain buildings in Appendix A, the first digit, which corresponds to the A_m / A_{FC} ratio, is taken as 6. The floor slab thickness has already been specified as 4 inches (of high density concrete), so the second digit in the system is 4. Finally, selecting a night-insulated system with an R-value of $4 \text{ deg.F-ft}^2\text{-hr/Btu}$ and two glazing layers, we obtain a system number of 6442 and record that number on the worksheet. Since the four-plex unit corresponds closely to this reference design, we are able to obtain an EHC / A_{FC} of $53.93 \text{ Btu/deg.F-ft}^2$ and a DHC / A_{FC} of 56.76 directly from Appendix A. These numbers also are recorded on Worksheet 3. Finally, the worksheet is completed by locating and recording the values of F , G , U_{FC} , and α specified for direct gain system number 6442 in Appendix A. The aperture size, 791 ft^2 , is also recorded to facilitate analysis of mixed systems.

In some instances a building might employ two different system types; Worksheet 3 allows for this possibility. To analyze a mixed system, repeat the above procedure for the second system and enter the component areas in the indicated blanks. The mixed system parameters are then calculated using the weighting procedure indicated on the worksheet.

5.3.5 Base temperature. Worksheet 4 for the base temperature is divided into two parts. The first part is used to calculate the base temperature when a constant thermostat setting is employed during the heating season. The second part is used to calculate the base temperature when a night time setback is employed in the building. For this example we shall adopt a setback strategy.

The daytime setting shall be 70 deg.F and is assumed to be in effect from 5 a.m. to 10 p.m. for a duration of 17 hours. The night time setpoint shall be 60 deg.F and has a duration of 7 hours. After entering these values on the worksheet, the indicated formulas are used to calculate the average setpoint of:

$$T_{ave} = 67.1 \text{ deg.F} \text{ .}$$

This number is entered on the worksheet and the time constant is calculated next. Based on previously recorded values for DHC , NLC , U_{TC} , and A_{TC} , the time constant is:

$$[\tau] = 30.9 \text{ hr} .$$

Using this number in the following equation on the worksheet we obtain an effective thermostat setpoint of:

$$T_{Te} = 67.5 \text{ deg.F} .$$

Finally, the base temperature is calculated from the last equation on the worksheet. The internal heat generation rate (Q_{int}) is taken to be the product of 20,000 Btu per person per day (a typical value) and 14, the probable number of occupants of a quadruplex (assuming an average family size of 3.5 persons). Using these assumptions, we obtain a base temperature of:

$$T_{Tb} = 59.5 = 60 \text{ deg.F} ,$$

and enter it on the worksheet.

5.3.6 Weather parameters. We begin filling out Worksheet 5, as indicated in the example, by entering the state and city in which the building is located. Then we turn to the weather tables presented in Appendix B and locate the column for a base temperature of 60deg.F and record the ANNUAL DD given in that column on the worksheet.

Next, record the parameters that characterize the direct gain system. The number of glazings is two, the azimuth is 15 degrees, and the tilt is zero.

The value of the south/vertical transmitted radiation to degree day ratio is obtained from the column marked TB60 (indicating a base temperature of 60deg.F) and the row labeled VT2/DD (indicating a double glazed system). The value found in the weather tables is:

$$(VT2/DD)_{T0} = 27.60 .$$

The subscript o indicates a south/vertical orientation.

Similarly, from the same column and the row marked PARAMETER A, we obtain:

$$a_{T0} = 0.637 ,$$

for a south/vertical orientation.

To correct for the azimuth of 15 degrees east, one simply records the value of A1 through A5 and B1 through B5 from the TB60 column and uses the referenced equations to obtain:

$$VT2/DD = 27.51 ,$$

and:

$$a = 0.616 ,$$

where the subscript i has been dropped because only a single system is present. As a general rule, the corrections for azimuth do not become significant until the departure from due south approaches ± 30 degrees.

If two systems having either different numbers of glazings or different orientations are employed it will be necessary to determine the weather parameters for the second system using the blanks provided. Then the weather parameters for the two systems are area weighted using the formula provided on the worksheet.

5.3.7 Auxiliary heat requirements. The auxiliary heat requirements of the building are calculated using Worksheet 6 which is reproduced for the example calculation. The scaled solar load ratio (SLR*) is computed from parameters previously recorded on other worksheets and found to be 0.64. Using this value and the city parameter (a) from Worksheet 5, the annual heat to load ratio is read from the nomograph in figure 23 as 0.37. Finally, using the formula at the bottom of the worksheet, calculate an annual auxiliary heat requirement of 32.6 MMBtu for the four-plex unit. Dividing this figure by the floor space of 6800 ft² and the annual heating degree days of 2778 yields an auxiliary heating factor of 1.73 Btu/ft²-DD.

5.3.8 Distribution of the solar aperture. In general, the total solar aperture of a multi-family unit should be distributed in a manner that provides greater solar gains to the sections of the unit that experience the greater loads. We can accomplish this by performing the calculations presented herein once for each unique thermal zone within a unit. The worksheets are set up to allow this procedure by entering appropriate values for the heated floorspace and using the specialized definition of total perimeter ($P_{T\gamma}$) that excludes partitions between distinct thermal zones. However, in many cases the much simpler procedure described below is adequate.

On Worksheet 2 we determined that the four-plex unit has a total NLC of 28,248 Btu/DD. Each of the four sections, therefore has, on the average, a NLC of 7,062 Btu/DD, or one fourth of the total value. The average NLC value must be adjusted to account for the different loss characteristics of the two unique thermal zones that exist in the four-plex units. The two outer sections will have a larger loss coefficient than the two interior sections which have two shared or common side walls. It is assumed that a negligible amount of heat is transferred through these common walls because only small temperature differences are likely to exist from one side to the other. The exterior side walls on the end sections, however, lose heat to ambient conditions that may be quite cold.

We can easily calculate the loss characteristics of the end walls using the equations on Worksheet 2. The end wall area is:

$$A_{T\gamma} = 18 \times 23 = 414 \text{ ft}^2$$

Note that we have assumed that there are no windows on the end walls. The load coefficient of the wall is therefore:

$$LC_{T\gamma} = 24 A_{T\gamma} / RWALL = 24 \times 414 / 21 = 473 \text{ Btu/DD}$$

Having obtained the end wall loss coefficient, the net load coefficient for an interior zone ($NLC_{i\gamma}$) is given by:

$$NLC_{i\gamma} = (NLC - 2 L_{\gamma} w_{\gamma}) / NZONE \quad , \quad (\text{Equation 5.21})$$

where NZONE is the number of zones, four in this case, for a row type building.

The net load coefficient of an exterior zone ($NLC_{e\gamma}$) is then given by:

$$NLC_{e\gamma} = NLC_{i\gamma} + L_{\gamma} w_{\gamma} \quad . \quad (\text{Equation 5.22})$$

Carrying out the computation yields:

$$NLC_{i\gamma} = 6,825 \text{ Btu/DD} \quad ,$$

$$NLC_{e\gamma} = 7,299 \text{ Btu/DD} \quad .$$

Equating the LCRs of interior and exterior sections to the original LCR of the complete unit yields the following simple equations for determining $A_{\gamma ci\gamma}$ and $A_{\gamma ce\gamma}$, the solar collection areas for the two sections:

$$A_{\gamma ci\gamma} = A_{\gamma c\gamma} (NLC_{i\gamma} / NLC) \quad , \quad (\text{Equation 5.23})$$

$$A_{\gamma ce\gamma} = A_{\gamma c\gamma} (NLC_{e\gamma} / NLC) \quad . \quad (\text{Equation 5.24})$$

Evaluation of these equations for the four-plex unit yields:

$$A_{\gamma ci\gamma} = 191 \text{ ft}^2 \quad ,$$

$$A_{\gamma ce\gamma} = 204 \text{ ft}^2 \quad .$$

Note that the aperture sizes differ by only 7 percent and the sizing could be performed with reasonable accuracy (for this example) by simply distributing the total aperture area uniformly among the sections. In that case:

$$A_{\gamma ci\gamma} = A_{\gamma ce\gamma} = 198 \text{ ft}^2 \quad ,$$

is the aperture size for interior and exterior sections.

5.3.9 System efficiencies. System efficiencies for the reference month are evaluated using Worksheet 7 in the example. The total effective load coefficient and the solar heating fraction are evaluated using parameters available on other worksheets, and recorded. Then the total efficiency is calculated from the equation provided on Worksheet 7. The result is:

$$e_{\gamma t\gamma} = 0.86 \quad .$$

Since the delivery efficiency of all direct gain systems is unity, the utilization efficiency has the same value as $e_{\gamma t\gamma}$, or:

$$e_{\gamma u\gamma} = 0.86 \quad .$$

This result indicates that 14 percent of the solar energy absorbed in the building during the harshest winter month (February for Norfolk at a base temperature of 60deg.F) must be ventilated to avoid driving the room air temperature more than 10deg.F above the thermostat setpoint.

5.3.10 Average maximum temperature. The average daily maximum temperature during the reference month is determined by the equations provided on Worksheet 8 which is reproduced in the examples.

The first equation gives the solar energy delivered to the living space during February which is the reference month. All quantities in the equation are available from previous worksheets except the monthly degree days (DD) which is obtained from Appendix B. Next, the excess solar energy is determined by taking the product of Q_{rD} and the compliment of the utilization efficiency. The excess solar energy is 1.69 MMBtu. The average temperature in the living space, assuming the excess solar energy

is ventilated, is \bar{T} which is found to have a value of 70.7 for this example. When a night time setback is employed, the effective thermostat

setpoint (T_{re}) is used for T_{rset} in the equation for \bar{T} . Finally, the temperature increment without ventilation ($[W-DELTA]T_{rI}$) is computed to

be 1.3deg.F which is added to \bar{T} to obtain an average daily maximum temperature of 72deg.F, which is well within the comfort range.

5.3.11 Incremental cooling load. The incremental cooling load is determined by filling out Worksheets 9 and 10 which are reproduced in the examples. First read the TOTAL ANNUAL TRANSMITTED RADIATION from the row marked DUE SOUTH AND VERTICAL in the weather table for Norfolk. Since the system is double glazed, select the quantity:

$$(QTA2)_{ro} = 232,584 \text{ Btu/ft}^2 \text{ .}$$

Then read and record C1 through C5 from the row marked AZIMUTH AND TILT COEF. and record them on the worksheet. Finally, using equation 5.15 as indicated, calculate the transmitted solar radiation corrected for azimuth and tilt. The result is:

$$QTA2 = 231,210 \text{ Btu/ft}^2 \text{ .}$$

The last equation on the worksheet yields:

$$Q_{rD} = 177.4 \times 10^6 \text{ Btu} \text{ ,}$$

for the delivered solar energy.

We begin filling out Worksheet 10 by selecting a maximum temperature of 80deg.F. In this case T_{rset} is 70deg.F which is the same value used for the auxiliary heat consumption analysis. Therefore, we may use the annual heat to load ratio and the auxiliary heat requirement that were previously recorded on Worksheet 6. Enter these numbers and calculate the annual solar heating fraction using the indicated equation. Then calculate the actual indoor temperature from the equation provided on Worksheet 10. The result is:

$$T_{ract} = 75.8 \text{ deg.F}$$

Next, the actual annual heating degree days is determined from Worksheet 4 by employing T_{act} in place of the daytime thermostat setpoint to obtain the base temperature:

$$T_{\text{b}} = 65.8 \text{deg.F} .$$

Referring to the weather table for Norfolk and interpolating between base temperatures of 65deg.F and 70deg.F, we obtain:

$$DD_{\text{act}} = 3,827 .$$

Now the actual annual heat load is calculated from the equation provided on Worksheet 9. The result is:

$$Q_{\text{act}} = 133.5 \times 10^6 \text{ Btu} .$$

Then the incremental cooling load is calculated from the final equation on the worksheet and found to be:

$$Q_{\text{I}} = 76.5 \times 10^6 \text{ Btu} .$$

This is quite a large number and points out the necessity for shading the solar aperture during the cooling season. Since our system has movable insulation, the means for providing the required shading is already in place.

5.3.12 Refining the design. The first refinement one might consider to the four-plex family housing unit would be to increase the building mass. This could most easily be accomplished by employing massive partitioning walls between the individual sections. The addition of more mass would increase the DHC and EHC of the unit and lead to a higher utilization efficiency thereby reducing the auxiliary heat requirements.

Additionally, the increase in utilization efficiency might lead one to consider reducing the size of the solar apertures. This strategy could reduce the incremental cooling load thereby improving building comfort and convenience. Alternately, covers or shading devices could be employed to reduce Q_{D} during the cooling season.

The quantitative effect of any design refinements on building performance can be determined by entering the change on the appropriate worksheet and working forward from that point.

6. NOTES

6.1 Intended use. In this handbook, the basic concepts of passive solar design have been outlined and the general climatic considerations that relate to its applicability in various regions of the continental United States have been discussed. Even in those regions where solar availability is low, building performance can always be improved by cost free measures such as proper building orientation and window distribution. The use of passive solar design can significantly reduce energy consumed for space heating both in existing buildings that may be retrofit and in new construction.

Guidelines for schematic design have been presented that should also prove useful for initial screening of building designs submitted in response to a turn key procurement action. More detailed design analysis procedures were provided for use in the design process or for final evaluation of candidate designs. Design refinement was discussed in terms of the efficiencies of a passive solar system, and finally example calculations were presented for a four-plex family housing unit to illustrate use of the procedures.

6.2 Data requirements. When this handbook is used in an acquisition and data are required to be delivered, the data requirements shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DOD FAR Supplement, Part 27, Sub-Part 27.410-6 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data shall be delivered by the contractor in accordance with the contractor purchase order requirements.

6.3 Subject term (key word) listing.

Solar design procedures
Passive solar design procedures
Heating systems

APPENDIX A

SYSTEM PERFORMANCE CORRELATION PARAMETERS

Direct Gain Systems

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio (A_{FM}/A_{GC}) (3, 6, or 9)

Second digit: Thermal storage mass thickness (THICK) (2, 4, or 6)

Third digit: R-value of night insulation (0, 4, or 9)

Fourth digit: Number of glazings (NGL) (1, 2, or 3)

System Number	F	G	U_{GC}	[alpha]	DHC/ A_{GC}	EHC/ A_{GC}	e_{Γ}
3201	0.458	22.73	1.10	0.94	14.94	14.49	1.
3202	0.576	10.49	0.49	0.94	14.94	14.49	1.
3203	0.661	6.65	0.31	0.94	14.94	14.49	1.
3241	0.608	9.77	0.61	0.94	14.94	14.49	1.
3242	0.623	5.21	0.35	0.94	14.94	14.49	1.
3243	0.669	3.53	0.28	0.94	14.94	14.49	1.
3291	0.637	8.33	0.53	0.94	14.94	14.49	1.
3292	0.651	3.77	0.27	0.94	14.94	14.49	1.
3293	0.685	2.33	0.19	0.94	14.94	14.49	1.
3401	0.754	24.89	1.10	0.94	28.38	27.85	1.
3402	0.838	10.73	0.49	0.94	28.38	27.85	1.
3403	0.886	6.17	0.31	0.94	28.38	27.85	1.
3441	0.822	10.25	0.61	0.94	28.38	27.85	1.
3442	0.834	4.97	0.35	0.94	28.38	27.85	1.
3443	0.875	3.05	0.28	0.94	28.38	27.85	1.
3491	0.832	8.57	0.53	0.94	28.38	27.85	1.
3492	0.852	3.48	0.27	0.94	28.38	27.85	1.
3493	0.882	1.80	0.19	0.94	28.38	27.85	1.
3601	0.826	25.13	1.10	0.94	35.79	36.73	1.
3602	0.894	10.49	0.49	0.94	35.79	36.73	1.
3603	0.943	5.93	0.31	0.94	35.79	36.73	1.
3641	0.870	10.01	0.61	0.94	35.79	36.73	1.
3642	0.870	4.49	0.35	0.94	35.79	36.73	1.
3643	0.910	2.57	0.28	0.94	35.79	36.73	1.
3691	0.865	8.09	0.53	0.94	35.79	36.73	1.
3692	0.889	3.00	0.27	0.94	35.79	36.73	1.
3693	0.916	1.32	0.19	0.94	35.79	36.73	1.
6201	0.719	25.06	1.10	0.97	29.88	28.05	1.
6202	0.812	10.90	0.49	0.97	29.88	28.05	1.
6203	0.867	6.34	0.31	0.97	29.88	28.05	1.
6241	0.786	10.18	0.61	0.97	29.88	28.05	1.
6242	0.810	5.14	0.35	0.97	29.88	28.05	1.
6243	0.857	3.22	0.28	0.97	29.88	28.05	1.

Direct Gain Systems - Continued

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Fourth digit: Number of glazings (NGL) (1, 2, or 3)

System Number	F	G	U_{GC}	[alpha]	DHC/ A_{GC}	EHC/ A_{GC}	e_{Γ}
6291	0.796	8.50	0.53	0.97	29.88	28.05	1.
6292	0.832	3.70	0.27	0.97	29.88	28.05	1.
6293	0.866	2.02	0.19	0.97	29.88	28.05	1.
6401	1.013	26.74	1.10	0.97	56.76	53.93	1.
6402	1.024	10.66	0.49	0.97	56.76	53.93	1.
6403	1.062	5.86	0.31	0.97	56.76	53.93	1.
6441	0.964	10.18	0.61	0.97	56.76	53.93	1.
6442	0.966	4.42	0.35	0.97	56.76	53.93	1.
6443	1.015	2.50	0.28	0.97	56.76	53.93	1.
6491	0.967	8.26	0.53	0.97	56.76	53.93	1.
6492	0.964	2.74	0.27	0.97	56.76	53.93	1.
6493	1.020	1.30	0.19	0.97	56.76	53.93	1.
6601	1.089	26.98	1.10	0.97	71.58	71.11	1.
6602	1.079	10.42	0.49	0.97	71.58	71.11	1.
6603	1.095	5.38	0.31	0.97	71.58	71.11	1.
6641	1.013	9.94	0.61	0.97	71.58	71.11	1.
6642	1.019	4.18	0.35	0.97	71.58	71.11	1.
6643	1.046	2.02	0.28	0.97	71.58	71.11	1.
6691	1.005	8.02	0.53	0.97	71.58	71.11	1.
6692	0.997	2.26	0.27	0.97	71.58	71.11	1.
6693	1.051	0.82	0.19	0.97	71.58	71.11	1.
9201	0.906	26.43	1.10	0.98	44.82	40.75	1.
9202	0.943	10.83	0.49	0.98	44.82	40.75	1.
9203	0.983	6.03	0.31	0.98	44.82	40.75	1.
9241	0.896	10.35	0.61	0.98	44.82	40.75	1.
9242	0.909	4.83	0.35	0.98	44.82	40.75	1.
9243	0.962	2.91	0.28	0.98	44.82	40.75	1.
9291	0.889	8.43	0.53	0.98	44.82	40.75	1.
9292	0.926	3.39	0.27	0.98	44.82	40.75	1.
9293	0.967	1.71	0.19	0.98	44.82	40.75	1.
9401	1.191	28.11	1.10	0.98	85.14	78.34	1.
9402	1.131	10.59	0.49	0.98	85.14	78.34	1.
9403	1.149	5.55	0.31	0.98	85.14	78.34	1.
9441	1.050	10.11	0.61	0.98	85.14	78.34	1.
9442	1.063	4.35	0.35	0.98	85.14	78.34	1.
9443	1.095	2.19	0.28	0.98	85.14	78.34	1.

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APPENDIX A

Direct Gain Systems - Continued

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio (A_{fm}/A_{gc}) (3, 6, or 9)

Second digit: Thermal storage mass thickness (THICK) (2, 4, or 6)

Third digit: R-value of night insulation (0, 4, or 9)

Fourth digit: Number of glazings (NGL) (1, 2, or 3)

System Number	F	G	U_{gc}	[alpha]	DHC/ A_{gc}	EHC/ A_{gc}	e_{τ}
9491	1.041	8.19	0.53	0.98	85.14	78.34	1.
9492	1.059	2.67	0.27	0.98	85.14	78.34	1.
9493	1.097	0.99	0.19	0.98	85.14	78.34	1.
9601	1.268	28.35	1.10	0.98	107.37	103.29	1.
9602	1.200	10.59	0.49	0.98	107.37	103.29	1.
9603	1.220	5.55	0.31	0.98	107.37	103.29	1.
9641	1.113	10.11	0.61	0.98	107.37	103.29	1.
9642	1.093	3.87	0.35	0.98	107.37	103.29	1.
9643	1.143	1.95	0.28	0.98	107.37	103.29	1.
9691	1.088	7.95	0.53	0.98	107.37	103.29	1.
9692	1.088	2.19	0.27	0.98	107.37	103.29	1.
9693	1.088	2.19	0.27	0.98	107.37	103.29	1.

Radiant Panels

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio (A_{fm}/A_{gc}) (3, 6, or 9)

Second digit: Thermal storage mass thickness (THICK) (4-inch only)

Third digit: Number of glazings (NGL) (2 only)

System Number	F	G	U_{gc}	[alpha]	DHC/ A_{gc}	EHC/ A_{gc}	e_{gc}
342	0.605	3.84	0.31	0.95	28.38	27.85	0.
642	0.734	3.60	0.31	0.95	56.76	53.93	0.
942	0.812	3.36	0.31	0.95	85.14	78.34	0.

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Thermosiphoning Air Panels
(Frontflow Systems with RTAP = 11)

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio (3, 6, or 9)

Second digit: Thermal storage mass thickness (THICK) (2, 4, or 6)

Third digit: Number of glazings (NGL) (1 or 2)

System Number	F	G	$U_{\Gamma C \Gamma}$	[alpha]	DHC/A $\Gamma C \Gamma$	$e_{\Gamma d \Gamma}$
321	0.277	1.63	0.068	0.95	14.94	0.36
322	0.336	1.54	0.064	0.95	14.94	0.58
341	0.330	1.63	0.068	0.95	28.38	0.36
342	0.398	1.54	0.064	0.95	28.38	0.58
361	0.341	1.63	0.068	0.95	35.79	0.36
362	0.411	1.54	0.064	0.95	35.79	0.58
621	0.477	1.63	0.068	0.95	29.88	0.36
622	0.573	1.54	0.064	0.95	29.88	0.58
641	0.563	1.63	0.068	0.95	56.76	0.36
642	0.673	1.54	0.064	0.95	56.76	0.58
661	0.585	1.63	0.068	0.95	71.58	0.36
662	0.699	1.54	0.064	0.95	71.58	0.58
921	0.649	1.63	0.068	0.95	44.82	0.36
922	0.744	1.54	0.064	0.95	44.82	0.58
941	0.756	1.63	0.068	0.95	85.14	0.36
942	0.896	1.54	0.064	0.95	85.14	0.58
961	0.787	1.63	0.068	0.95	107.37	0.36
962	0.932	1.54	0.064	0.95	107.37	0.58

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APPENDIX A

Unvented Trombe Walls

SYSTEM NUMBERING CONVENTION

- First digit: Mass thickness (1, 2, 3, or 4 implies 6-inch, 9-inch, 12-inch, or 18-inch, respectively)
 Second digit: $\rho c k$ product (1, 2, or 3 implies 7.5, 15, or 30, respectively)
 Third digit: R-value of night insulation (0 or 9)
 Fourth digit: Number of glazings (NGL) (1, 2, or 3)
 Fifth digit: Wall surface (1 or 2 implies flat black surface or selective surface, respectively)

System Number	F	G	U_{rc}	[alpha]	e_{rd}
11021	0.240	2.86	0.19	0.95	0.51
12021	0.551	5.04	0.24	0.95	0.64
13021	0.616	6.00	0.27	0.95	0.72
21021	0.208	2.14	0.16	0.95	0.43
22021	0.291	3.10	0.21	0.95	0.56
23021	0.343	3.82	0.25	0.95	0.67
31021	0.466	1.66	0.14	0.95	0.38
32021	0.496	3.60	0.19	0.95	0.51
33011	0.484	7.44	0.29	0.95	0.52
33012	0.166	3.12	0.23	0.90	0.62
33021	0.644	4.80	0.24	0.95	0.64
33022	0.802	2.16	0.20	0.90	0.72
33031	0.761	3.36	0.20	0.95	0.78
33911	0.611	3.12	0.20	0.95	0.52
33912	0.812	0.72	0.15	0.90	0.62
33921	0.755	1.68	0.15	0.95	0.64
33922	0.877	0.48	0.13	0.90	0.72
33931	0.539	0.02	0.13	0.95	0.78
41021	0.126	1.18	0.11	0.95	0.29
42021	0.406	2.88	0.16	0.95	0.43
43021	0.570	3.84	0.21	0.95	0.56

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APPENDIX A

Vented Trombe Walls

SYSTEM NUMBERING CONVENTION

- First digit: Mass thickness (1, 2, 3, or 4 implies 6-inch, 9-inch, 12-inch, or 18-inch, respectively)
 Second digit: $\rho c k$ product (1, 2, or 3 implies 7.5, 15, or 30, respectively)
 Third digit: R-value of night insulation (0 or 9)
 Fourth digit: Number of glazings (NGL) (1, 2, or 3)
 Fifth digit: Wall surface (1 or 2 implies flat black surface or selective surface, respectively)

System Number	F	G	U_{rc}	[alpha]	e_{rd}
11021	0.292	3.10	0.19	0.95	0.72
12021	0.605	5.28	0.24	0.95	0.74
13021	0.629	6.00	0.27	0.95	0.76
21021	0.280	2.38	0.16	0.95	0.69
22021	0.654	4.78	0.21	0.95	0.72
23021	0.725	5.74	0.25	0.95	0.74
31021	0.259	2.14	0.14	0.95	0.67
32021	0.638	4.32	0.19	0.95	0.70
33011	0.545	7.92	0.29	0.95	0.57
33012	0.809	3.60	0.23	0.90	0.70
33021	0.741	5.28	0.24	0.95	0.72
33022	0.900	2.64	0.20	0.90	0.79
33031	0.872	3.84	0.20	0.95	0.80
33911	0.728	4.08	0.20	0.95	0.57
33912	0.924	1.44	0.15	0.90	0.70
33921	0.861	2.16	0.15	0.95	0.72
33922	0.983	0.96	0.13	0.90	0.79
33931	0.595	0.22	0.13	0.95	0.80
41021	0.215	1.66	0.11	0.95	0.65
42021	0.570	3.60	0.16	0.95	0.67
43021	0.709	4.56	0.21	0.95	0.70

Water Walls

SYSTEM NUMBERING CONVENTION

- First digit: Wall thickness (1, 2, 3, 4, 5, or 6 implies 3-inch, 6-inch, 9-inch, 12-inch, 18-inch, or 24-inch, respectively)
- Second digit: R-value of night insulation (0 or 9)
- Third digit: Number of glazings (NGL) (1, 2, or 3)
- Fourth digit: Wall surface (1 or 2 implies flat black surface or selective surface, respectively)

System Number	F	G	U_{rc}	[alpha]	e_{rd}
1021	0.684	6.94	0.31	0.95	0.83
2021	0.833	6.48	0.31	0.95	0.83
3011	0.735	10.80	0.41	0.95	0.73
3012	0.904	3.36	0.30	0.90	0.80
3021	0.885	6.24	0.31	0.95	0.83
3022	0.973	2.40	0.24	0.90	0.86
3031	0.981	4.06	0.25	0.95	0.98
3911	0.873	3.84	0.25	0.95	0.73
3912	0.960	0.48	0.17	0.90	0.80
3921	0.981	1.92	0.18	0.95	0.83
3922	0.992	0.00	0.14	0.90	0.86
3931	1.039	0.94	0.15	0.95	0.98
4021	0.907	6.00	0.31	0.95	0.83
5021	0.931	5.74	0.31	0.95	0.83
6021	0.954	5.74	0.31	0.95	0.83

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APPENDIX A

Concrete Block Walls

SYSTEM NUMBERING CONVENTION

- First digit: Unfilled or filled (1 implies unfilled blocks and 2 implies filled blocks)
 Second digit: R-value of night insulation (0 or 9)
 Third digit: Number of glazings (NGL) (1 or 2)

System Number	F	G	U _{ΓC}	[alpha]	e _{Γd}
101	0.454	6.04	0.42	0.95	0.55
102	0.500	3.88	0.28	0.95	0.55
191	0.563	3.16	0.13	0.95	0.55
192	0.607	1.96	0.11	0.95	0.55
201	0.575	6.76	0.47	0.95	0.59
202	0.630	4.36	0.31	0.95	0.59
291	0.737	3.64	0.14	0.95	0.59
292	0.749	1.96	0.12	0.95	0.59

Sunspaces

SYSTEM NUMBERING CONVENTION

- First digit: Sunspace type (1 or 2 implies attached or semi-enclosed, respectively)
- Second digit: Glazing tilt from vertical (1 or 2 implies 0 degrees or 40 degrees, respectively)
- Third digit: Common wall (1 or 2 implies masonry or insulated, respectively)
- Fourth digit: R-value of night insulation (0 or 9)

System Number	F	G	$U_{\Gamma C \Gamma}$	[alpha]	$e_{\Gamma d \Gamma}$
1210	0.551	5.76	0.27	0.96	0.70
1219	0.673	3.12	0.21	0.96	0.70
1220	0.516	7.20	0.04	0.94	0.53
1229	0.659	4.08	0.04	0.94	0.53
2110	0.786	6.96	0.38	0.95	0.71
2119	0.886	4.32	0.28	0.95	0.71
2120	0.580	5.28	0.08	0.94	0.54
2129	0.750	3.84	0.08	0.94	0.54
2210	0.699	6.96	0.36	0.96	0.68
2219	0.826	3.36	0.26	0.96	0.68
2220	0.607	6.48	0.07	0.94	0.50
2229	0.772	3.12	0.07	0.94	0.50

APPENDIX B

WEATHER PARAMETERS

BIRMINGHAM, ALABAMA

ELEVATION = 630 LAT = 33.6

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	976.38	184.18	115.04	79.15	57.93	43.80	34.11	27.59	19.94			
VT2/DD	831.23	156.80	97.94	67.38	49.31	37.29	29.04	23.49	16.98			
VT3/DD	721.52	136.11	85.01	58.49	42.81	32.37	25.21	20.39	14.74			
MONTHLY DD	23	121	194	282	385	509	654	808	1118			
ANNUAL DD	54	314	581	977	1504	2174	3019	4077	6849			
PARAMETER A	.179	.658	.681	.642	.590	.568	.568	.591	.622			
AZIMUTH AND TILT COEF.												
A1	.1719	.0429	.0440	.0487	.0540	.0563	.0564	.0547	.0548			
A2	-.2003	.0246	.0918	.1859	.2918	.3755	.4420	.5079	.7050			
A3	-.0228	-.0836	-.1625	-.2819	-.4180	-.5272	-.6160	-.7059	-.9853			
A4	-.0601	.0376	.0870	.1586	.2404	.3073	.3620	.4167	.5781			
A5	-.1798	-.0373	-.0370	-.0428	-.0507	-.0595	-.0689	-.0797	-.1144			
B1	-.0445	-.0445	-.0445	-.0445	-.0445	-.0445	-.0445	-.0445	-.0445			
B2	-.9584	-.9584	-.9584	-.9584	-.9584	-.9584	-.9584	-.9584	-.9584			
B3	.5777	.5777	.5777	.5777	.5777	.5777	.5777	.5777	.5777			
B4	.9117	.9117	.9117	.9117	.9117	.9117	.9116	.9116	.9117			
B5	-1.2260	-1.2261	-1.2260	-1.2260	-1.2260	-1.2260	-1.2260	-1.2260	-1.2260			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 265272 QTA2 = 220764 QTA3 = 189712												
AZIMUTH AND TILT COEF. C1 = -.0170 C2 = -.2050 C3 = -.4159 C4 = 1.7706 C5 = -1.1628												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	43	46	53	62	70	75	79	77	72	62	53	44
QHOR:	710	943	1284	1633	1914	1864	1796	1660	1481	1217	841	641

MOBILE, ALABAMA

ELEVATION = 220 LAT = 30.7

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	1863.20	538.38	239.86	134.50	84.03	57.44	42.50	27.39			
VT2/DD	NA	1583.23	457.48	203.81	114.29	71.40	48.81	36.11	23.27			
VT3/DD	NA	1374.00	397.02	176.88	99.18	61.97	42.36	31.34	20.20			
MONTHLY DD	0	13	44	99	177	283	414	559	867			
ANNUAL DD	0	31	132	326	642	1130	1795	2658	5184			
PARAMETER A	NA	.702	.664	.567	.483	.466	.477	.493	.557			
AZIMUTH AND TILT COEF.												
A1	NA	-.0000	-.0060	-.0088	-.0120	-.0139	-.0135	-.0111	-.0005			
A2	NA	.3814	.3263	.3541	.4269	.4776	.5399	.6155	.7940			
A3	NA	-.4803	-.4196	-.4599	-.5605	-.6366	-.7243	-.8270	-1.0796			
A4	NA	.2349	.2047	.2232	.2733	.3136	.3613	.4190	.5543			
A5	NA	.0053	-.0001	-.0021	-.0078	-.0184	-.0276	-.0365	-.0577			
B1	NA	-.0081	-.0081	-.0081	-.0081	-.0081	-.0081	-.0081	-.0081			
B2	NA	-.9077	-.9077	-.9077	-.9077	-.9077	-.9077	-.9077	-.9077			
B3	NA	.5141	.5142	.5142	.5141	.5141	.5141	.5141	.5141			
B4	NA	1.0145	1.0144	1.0144	1.0144	1.0144	1.0145	1.0145	1.0144			
B5	NA	-1.2019	-1.2019	-1.2019	-1.2019	-1.2019	-1.2019	-1.2019	-1.2019			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 267445 QTA2 = 222797 QTA3 = 191687												
AZIMUTH AND TILT COEF. C1 = .0301 C2 = -.1798 C3 = -.3900 C4 = 1.7247 C5 = -1.0617												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	52	52	59	64	74	78	79	76	76	68	58	53
QHOR:	843	1089	1464	1696	1853	1794	1731	1586	1475	1323	933	757

MONTGOMERY, ALABAMA

ELEVATION = 203 LAT = 32.3

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	371.03	199.56	115.75	74.56	52.93	40.13	32.04	22.62			
VT2/DD	NA	316.52	170.24	98.47	63.43	45.03	34.14	27.26	19.24			
VT3/DD	NA	274.88	147.85	85.48	55.06	39.08	29.63	23.66	16.70			
MONTHLY DD	8	68	127	205	318	448	591	741	1049			
ANNUAL DD	19	185	379	695	1155	1774	2572	3546	6202			
PARAMETER A	NA	.428	.374	.419	.468	.510	.537	.550	.590			
AZIMUTH AND TILT COEF.												
A1	NA	-.1373	-.1652	.1489	.1270	.1100	.0982	.0890	.0679			
A2	NA	.4976	.6239	.1030	.1649	.2192	.2899	.3923	.6379			
A3	NA	-.4841	-.6160	-.1237	-.2002	-.2692	-.3639	-.5037	-.8520			
A4	NA	.2692	.3501	.1693	.2073	.2458	.3040	.3887	.5819			
A5	NA	.1118	.1279	-.0444	-.0436	-.0467	-.0573	-.0738	-.1124			
B1	NA	.0575	.0575	-.0241	-.0241	-.0241	-.0241	-.0241	-.0241			
B2	NA	-1.0340	-1.0340	-.9219	-.9219	-.9219	-.9219	-.9219	-.9219			
B3	NA	.6305	.6305	.4981	.4981	.4980	.4980	.4981	.4981			
B4	NA	.8497	.8497	.9378	.9378	.9378	.9378	.9378	.9378			
B5	NA	-1.2590	-1.2590	-1.2456	-1.2456	-1.2457	-1.2456	-1.2456	-1.2456			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 268541 QTA2 = 223433 QTA3 = 192017												
AZIMUTH AND TILT COEF. C1 = .0006 C2 = -.1783 C3 = -.4647 C4 = 1.8211 C5 = -1.1514												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	46	48	57	65	71	78	79	80	75	64	54	46
QHOR:	756	926	1345	1723	1883	1969	1876	1723	1534	1203	905	730

PHOENIX, ARIZONA			ELEVATION = 1112						LAT = 33.4			
SOUTH-VERT. (M=12)			TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	
VT1/DD	NA	(M=12)	1425.49	562.22	293.33	176.30	118.82	85.84	64.94	42.15		
VT2/DD	NA	(M=12)	1219.26	480.88	250.89	150.80	101.63	73.42	55.54	36.05		
VT3/DD	NA	(M=12)	1059.44	417.85	218.01	131.03	86.31	63.80	48.26	31.33		
MONTHLY DD	1		26	66	126	209	310	429	567	874		
ANNUAL DD	1		43	140	328	634	1090	1713	2503	4544		
PARAMETER A	NA		.508	.594	.594	.573	.556	.531	.514	.488		
AZIMUTH AND TILT COEF.												
A1	NA		-.0377	-.0388	-.0372	-.0343	-.0313	-.0299	-.0284	-.0251		
A2	NA		.1179	.2200	.3586	.4854	.6118	.7523	.8935	1.2002		
A3	NA		-.0995	-.2095	-.3666	-.5172	-.6769	-.8587	-1.0471	-1.4688		
A4	NA		.0961	.1693	.2706	.3655	.4640	.5748	.6858	.9244		
A5	NA		.0141	.0156	.0135	.0069	-.0069	-.0252	-.0463	-.0972		
B1	NA		.0249	.0249	.0249	.0249	.0249	.0249	.0249	.0249		
B2	NA		-1.1544	-1.1544	-1.1544	-1.1544	-1.1544	-1.1544	-1.1544	-1.1544		
B3	NA		.7236	.7236	.7237	.7237	.7237	.7237	.7237	.7236		
B4	NA		.7977	.7977	.7977	.7977	.7977	.7977	.7977	.7977		
B5	NA		-1.3211	-1.3210	-1.3210	-1.3210	-1.3210	-1.3210	-1.3210	-1.3211		
TOTAL ANNUAL TRANSMITTED RADIATION			QTA1 = 377059			QTA2 = 313598			QTA3 = 269197			
DUE SOUTH AND VERTICAL			C1 = .0268	C2 = -.1794	C3 = -.5866	C4 = 1.9450	C5 = -1.3422					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	52	54	61	68	78	88	92	90	85	72	60	51
QHOR:	1025	1402	1849	2330	2708	2696	2428	2290	2031	1571	1207	920

PRESCOTT, ARIZONA			ELEVATION = 5023						LAT = 34.7			
SOUTH-VERT. (M=12)			TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	
VT1/DD	533.11	(M=12)	173.78	117.35	85.99	66.71	53.84	44.95	38.47	31.50		
VT2/DD	456.61	(M=12)	148.85	100.52	73.65	57.14	46.11	38.50	32.95	25.39		
VT3/DD	396.89	(M=12)	129.38	87.37	64.01	49.66	40.08	33.46	28.64	21.41		
MONTHLY DD	78		238	352	481	620	768	920	1075	886		
ANNUAL DD	179		784	1304	1975	2801	3783	4937	6261	9332		
PARAMETER A	.751		.584	.536	.498	.463	.436	.415	.400	.343		
AZIMUTH AND TILT COEF.												
A1	NA		-.0055	-.0020	.0034	.0098	.0171	.0244	.0314	.0386	-.1797	
A2	NA		-.2413	-.6056	-.8188	-1.0620	-1.3367	-1.6143	-1.8697	-2.1141	-6.3069	
A3	NA		-.2371	-.6339	-.9000	-1.2170	-1.5710	-1.9282	-2.2571	-2.5817	-8.3292	
A4	NA		-.1417	-.3664	-.5108	-.6803	-.8695	-1.0605	-1.2363	-1.4101	-4.2555	
A5	NA		.0275	.0471	.0330	.0080	-.0151	-.0363	-.0547	-.0808	.5901	
B1	NA		-.0079	-.0079	-.0079	-.0079	-.0079	-.0079	-.0079	-.0079	.0759	
B2	NA		-1.2022	-1.2022	-1.2023	-1.2023	-1.2023	-1.2023	-1.2022	-1.2022	.6718	
B3	NA		.7491	.7491	.7491	.7492	.7491	.7492	.7491	.7491	-1.7396	
B4	NA		.7470	.7470	.7470	.7470	.7470	.7470	.7470	.7470	2.7328	
B5	NA		-1.3476	-1.3476	-1.3476	-1.3476	-1.3476	-1.3476	-1.3476	-1.3476	-1.5482	
TOTAL ANNUAL TRANSMITTED RADIATION			QTA1 = 385714			QTA2 = 321257			QTA3 = 275902			
DUE SOUTH AND VERTICAL			C1 = .0378	C2 = -.1548	C3 = -.6027	C4 = 1.8583	C5 = -1.3820					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	36	38	46	50	60	72	75	71	68	57	44	35
QHOR:	1044	1318	1819	2316	2623	2761	2269	2051	1928	1570	1140	931

TUCSON, ARIZONA			ELEVATION = 2556						LAT = 32.1			
SOUTH-VERT. (M=12)			TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	
VT1/DD	NA	(M=12)	1309.57	592.71	318.25	191.14	127.55	92.13	69.24	45.07		
VT2/DD	NA	(M=12)	1120.40	507.09	272.28	163.53	107.96	77.98	59.12	38.49		
VT3/DD	NA	(M=12)	973.71	440.70	236.63	142.12	93.59	67.60	51.37	33.44		
MONTHLY DD	3		31	68	127	211	289	400	577	886		
ANNUAL DD	5		69	185	416	794	1330	2025	2879	5152		
PARAMETER A	NA		.645	.510	.422	.403	.401	.373	.364	.376		
AZIMUTH AND TILT COEF.												
A1	NA		.0178	.0264	.0358	.0398	-.0233	-.0197	.0271	.0332		
A2	NA		.4491	.6493	.8979	1.0423	-.4393	-.2420	1.2912	1.6468		
A3	NA		-.5059	-.7196	-1.0019	-1.1890	-.3507	-.0681	-1.7162	-2.2131		
A4	NA		.2814	.4009	.5597	.6640	-.2081	-.0603	.9499	1.2077		
A5	NA		.0175	.0353	.0428	.0275	-.1298	-.1665	-.1626	-.2132		
B1	NA		-.0049	-.0049	-.0049	-.0049	-.0142	-.0142	.0015	.0015		
B2	NA		-1.1887	-1.1887	-1.1887	-1.1887	-.8480	-.8480	-1.1138	-1.1138		
B3	NA		.7300	.7300	.7300	.7300	.2412	.2412	.6298	.6298		
B4	NA		.8442	.8442	.8442	.8442	1.2516	1.2516	.9238	.9238		
B5	NA		-1.3533	-1.3533	-1.3533	-1.3533	-1.4306	-1.4306	-1.3634	-1.3634		
TOTAL ANNUAL TRANSMITTED RADIATION			QTA1 = 372002			QTA2 = 309460			QTA3 = 265702			
DUE SOUTH AND VERTICAL			C1 = .0379	C2 = -.1607	C3 = -.6371	C4 = 1.9989	C5 = -1.3575					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	51	51	59	67	73	84	85	83	79	69	57	51
QHOR:	1083	1416	1873	2386	2691	2719	2307	2178	1954	1634	1207	1012

WINSLOW, ARIZONA

ELEVATION = 4882

LAT = 35.0

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	610.64	160.36	107.84	79.45	62.19	50.91	43.02	37.24	29.35			
VT2/DD	523.30	137.42	92.42	68.09	53.30	43.63	36.87	31.91	25.15			
VT3/DD	454.88	119.45	80.33	59.19	46.33	37.93	32.05	27.74	21.86			
MONTHLY DD	70	268	398	541	691	844	998	1153	1463			
ANNUAL DD	217	913	1476	2180	3029	4014	5147	6429	9413			
PARAMETER A	.372	.483	.482	.465	.448	.428	.412	.396	.339			
AZIMUTH AND TILT COEF.												
A1	.0869	.0694	.0721	.0769	.0819	.0869	.0907	.0953	.1192			
A2	.7940	.7700	.8998	1.0757	1.2741	1.4987	1.7301	1.9838	2.7808			
A3	-.7536	-.7985	-.9646	-1.1832	-1.4335	-1.7240	-2.0336	-2.3778	-3.4503			
A4	.4309	.4422	.5297	.6464	.7809	.9369	1.1022	1.2860	1.8642			
A5	.1183	.0700	.0609	.0527	.0397	.0191	-.0095	-.0439	-.1460			
B1	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130			
B2	-1.2315	-1.2315	-1.2315	-1.2315	-1.2315	-1.2315	-1.2315	-1.2315	-1.2315			
B3	.7824	.7824	.7824	.7824	.7824	.7824	.7824	.7824	.7824			
B4	.7369	.7369	.7369	.7369	.7369	.7369	.7369	.7369	.7369			
B5	-1.3494	-1.3494	-1.3494	-1.3494	-1.3493	-1.3494	-1.3494	-1.3494	-1.3494			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 389291			QTA2 = 324229			QTA3 = 278408					
AZIMUTH AND TILT COEF.	C1 = .0556			C2 = -.2014			C3 = -.5588					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	34	36	45	52	63	72	78	74	69	55	43	32
QHQR:	1020	1329	1756	2345	2625	2726	2382	2131	1931	1521	1107	950

YUMA, ARIZONA

ELEVATION = 207

LAT = 32.7

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	NA	NA	2412.82	807.75	367.48	193.30	119.58	83.27	50.19			
VT2/DD	NA	NA	2064.05	690.99	314.36	165.02	102.09	71.09	42.85			
VT3/DD	NA	NA	1793.66	600.47	273.18	143.37	88.69	61.76	37.22			
MONTHLY DD	0	4	16	48	106	200	324	465	771			
ANNUAL DD	0	8	36	119	308	654	1171	1870	3801			
PARAMETER A	NA	NA	.196	.362	.446	.567	.617	.611	.551			
AZIMUTH AND TILT COEF.												
A1	NA	NA	.0007	.0036	.0071	.0153	.0189	.0227	.0318			
A2	NA	NA	.6003	.4205	.4447	.2406	.3675	.5024	.8731			
A3	NA	NA	-.5490	-.3997	-.4581	-.3386	-.5047	-.6855	-1.1985			
A4	NA	NA	.4319	.3057	.3270	.1856	.2789	.3798	.6595			
A5	NA	NA	.0441	.0225	.0046	-.0445	-.0600	-.0793	-.1413			
B1	NA	NA	-.0074	-.0074	-.0074	-.0092	-.0092	-.0092	-.0092			
B2	NA	NA	-1.1756	-1.1756	-1.1756	-1.1073	-1.1073	-1.1073	-1.1073			
B3	NA	NA	.7259	.7259	.7259	.6344	.6344	.6344	.6344			
B4	NA	NA	.8267	.8267	.8267	.9261	.9261	.9261	.9261			
B5	NA	NA	-1.3306	-1.3305	-1.3306	-1.3500	-1.3500	-1.3500	-1.3501			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 381823			QTA2 = 317478			QTA3 = 272506					
AZIMUTH AND TILT COEF.	C1 = .0116			C2 = -.1436			C3 = -.6535					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	55	60	64	71	80	86	92	92	87	74	63	56
QHQR:	1071	1498	1940	2421	2737	2824	2529	2327	2070	1603	1217	986

FORT SMITH, ARKANSAS

ELEVATION = 463

LAT = 35.3

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	744.93	148.36	91.65	64.14	48.50	38.68	32.02	27.28	20.95			
VT2/DD	636.56	126.78	78.32	54.81	41.45	33.05	27.36	23.31	17.91			
VT3/DD	552.98	110.13	68.04	47.61	36.01	28.11	23.77	20.25	15.56			
MONTHLY DD	38	188	305	436	577	723	873	1025	1335			
ANNUAL DD	104	512	908	1425	2074	2844	3734	4770	7453			
PARAMETER A	.324	.598	.606	.597	.578	.563	.554	.552	.569			
AZIMUTH AND TILT COEF.												
A1	.0381	.0166	.0149	.0144	.0154	.0173	.0193	.0204	.0187			
A2	.5304	.3119	.3550	.4047	.4700	.5397	.6136	.6948	.9119			
A3	-.5156	-.3123	-.3546	-.4041	-.4727	-.5505	-.6388	-.7468	-1.0688			
A4	.3256	.1979	.2273	.2610	.3065	.3569	.4121	.4758	.6526			
A5	.1039	.0506	.0565	.0630	.0688	.0712	.0691	.0587	.0082			
B1	-.0184	-.0184	-.0184	-.0184	-.0184	-.0184	-.0184	-.0184	-.0184			
B2	-1.1013	-1.1013	-1.1013	-1.1013	-1.1013	-1.1013	-1.1013	-1.1013	-1.1013			
B3	.6859	.6859	.6859	.6859	.6859	.6859	.6859	.6859	.6859			
B4	.7916	.7916	.7916	.7916	.7916	.7916	.7916	.7916	.7916			
B5	-1.2873	-1.2873	-1.2873	-1.2873	-1.2873	-1.2873	-1.2872	-1.2873	-1.2873			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 293307			QTA2 = 244328			QTA3 = 209951					
AZIMUTH AND TILT COEF.	C1 = -.0245			C2 = -.2424			C3 = -.4149					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	36	42	49	63	70	76	81	79	74	61	49	41
QHQR:	729	1014	1322	1696	1949	2019	2031	1872	1550	1183	872	713

LITTLE ROCK, ARKANSAS												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
ELEVATION = 266 LAT = 34.7												
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	817.22	192.15	116.58	78.27	56.62	43.64	35.27	29.42	22.02			
VT2/DD	697.10	163.90	99.44	66.77	48.30	37.22	30.08	25.09	18.78			
VT3/DD	605.37	142.33	86.36	57.98	41.94	32.32	26.13	21.79	16.31			
MONTHLY DD	33	141	232	345	477	620	767	919	1228			
ANNUAL DD	58	361	683	1141	1738	2455	3316	4346	7010			
PARAMETER A	.690	.644	.597	.552	.520	.502	.497	.508	.537			
AZIMUTH AND TILT COEF.												
A1	-.0295	-.0490	-.0536	-.0584	-.0608	-.0609	-.0583	-.0532	-.0411			
A2	-.0744	.1644	.2398	.3284	.4110	.4842	.5584	.6322	.8358			
A3	-.0944	-.2041	-.2901	-.3869	-.4785	-.5635	-.6554	-.7552	-1.0488			
A4	.0460	.1059	.1583	.2182	.2753	.3286	.3865	.4484	.6200			
A5	.0071	.0135	.0187	.0278	.0344	.0360	.0315	.0189	-.0270			
B1	-.0379	-.0379	-.0379	-.0379	-.0379	-.0379	-.0379	-.0379	-.0379			
B2	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327			
B3	.6204	.6204	.6204	.6204	.6204	.6204	.6204	.6204	.6204			
B4	.8546	.8546	.8546	.8546	.8546	.8546	.8546	.8546	.8546			
B5	-1.2710	-1.2709	-1.2710	-1.2710	-1.2710	-1.2709	-1.2710	-1.2710	-1.2710			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 287021 QTA2 = 239109 QTA3 = 205527												
AZIMUTH AND TILT COEF. C1 = -.0545 C2 = -.2231 C3 = -.4217 C4 = 1.7532 C5 = -1.2047												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	40	43	52	63	71	78	79	80	73	63	50	43
QHQR:	772	991	1279	1617	1967	2045	1991	1798	1517	1243	847	705

ARCATA, CALIFORNIA												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
ELEVATION = 226 LAT = 41.0												
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	NA	762.45	276.29	123.52	66.10	42.45	30.89	24.27	16.99			
VT2/DD	NA	650.85	235.85	105.60	56.51	36.29	26.41	20.75	14.52			
VT3/DD	NA	565.10	204.78	91.72	49.08	31.52	22.94	18.02	12.61			
MONTHLY DD	0	25	69	142	266	413	568	723	1033			
ANNUAL DD	1	71	279	792	1794	3318	5091	6908	10555			
PARAMETER A	NA	.673	.674	.634	.669	.661	.592	.532	.457			
AZIMUTH AND TILT COEF.												
A1	NA	.0109	-.0136	-.1111	-.1207	-.1464	-.1925	-.2347	-.2975			
A2	NA	.1799	.4199	.8350	.9546	1.1880	1.5322	1.8336	2.2748			
A3	NA	-.2113	-.5021	-.8970	-1.0785	-1.4154	-1.8536	-2.2193	-2.7416			
A4	NA	.1090	.2946	.5978	.7155	.9275	1.2104	1.4494	1.7932			
A5	NA	.0207	.0046	.0348	-.0071	-.0665	-.1011	-.1156	-.1254			
B1	NA	.0179	.0179	.0482	.0482	.0482	.0482	.0482	.0482			
B2	NA	-1.0316	-1.0316	-1.0918	-1.0919	-1.0919	-1.0919	-1.0919	-1.0919			
B3	NA	.6913	.6913	.7536	.7536	.7536	.7537	.7537	.7536			
B4	NA	.7164	.7164	.6383	.6383	.6383	.6383	.6383	.6383			
B5	NA	-1.1481	-1.1482	-1.1439	-1.1440	-1.1439	-1.1439	-1.1439	-1.1439			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 256991 QTA2 = 214291 QTA3 = 184258												
AZIMUTH AND TILT COEF. C1 = -.1083 C2 = -.2981 C3 = -.2423 C4 = 1.5907 C5 = -1.1414												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	46	47	47	48	52	54	55	56	55	53	50	46
QHQR:	545	794	1047	1644	1874	1883	1798	1560	1344	968	546	465

BAKERSFIELD, CALIFORNIA												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
ELEVATION = 492 LAT = 35.4												
SOUTH-VERT. (M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	NA	984.79	335.69	159.03	90.08	59.33	43.64	34.32	24.00			
VT2/DD	NA	841.91	286.98	135.96	77.01	50.72	37.31	29.34	20.52			
VT3/DD	NA	731.29	249.28	118.10	66.89	44.06	32.41	25.48	17.82			
MONTHLY DD	1	25	74	156	275	417	567	721	1031			
ANNUAL DD	1	55	199	489	974	1661	2528	3576	6185			
PARAMETER A	NA	.491	.531	.555	.642	.728	.765	.783	.789			
AZIMUTH AND TILT COEF.												
A1	NA	-.0626	-.0566	-.0478	-.0346	-.0253	-.0201	-.0165	-.0115			
A2	NA	.1308	.2067	.2578	.2796	.3249	.4148	.5175	.7283			
A3	NA	-.1689	-.2545	-.3122	-.3441	-.4161	-.5498	-.7000	-1.0085			
A4	NA	.1251	.1858	.2288	.2454	.2816	.3542	.4365	.6062			
A5	NA	-.0249	-.0306	-.0361	-.0428	-.0589	-.0839	-.1099	-.1633			
B1	NA	-.0154	-.0154	-.0154	-.0154	-.0154	-.0154	-.0154	-.0154			
B2	NA	-1.1376	-1.1376	-1.1376	-1.1376	-1.1376	-1.1376	-1.1376	-1.1376			
B3	NA	.7532	.7532	.7532	.7532	.7532	.7532	.7532	.7532			
B4	NA	.7764	.7764	.7764	.7764	.7764	.7764	.7764	.7764			
B5	NA	-1.2308	-1.2309	-1.2308	-1.2308	-1.2308	-1.2308	-1.2308	-1.2309			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 341443 QTA2 = 283234 QTA3 = 242759												
AZIMUTH AND TILT COEF. C1 = -.0253 C2 = -.0981 C3 = -.6830 C4 = 2.0218 C5 = -1.3427												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	45	51	57	62	69	78	83	82	76	66	56	46
QHQR:	782	1132	1648	2164	2507	2762	2713	2413	2003	1470	988	676

CHINA LAKE, CALIFORNIA										ELEVATION = 2234					LAT = 35.7
SOUTH-VERT. (M=12)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80					
VT1/DD	NA	533.27	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)					
VT2/DD	NA	457.08	251.86	215.88	147.62	98.07	70.87	54.72	44.52	32.41					
VT3/DD	NA	397.29	187.64	109.97	73.06	52.80	40.77	33.17	24.14						
MONTHLY DD	6	69	147	250	377	521	675	830	1140						
ANNUAL DD	12	168	388	740	1245	1915	2751	3735	6127						
PARAMETER A	NA	.415	.563	.623	.640	.633	.607	.575	.523						
AZIMUTH AND TILT COEF.															
A1	NA	.0110	.0066	.0048	.0036	.0029	.0023	.0020	.0015						
A2	NA	.2647	.2505	.3021	.4120	.5591	.7317	.9139	1.2853						
A3	NA	-.1845	-.1945	-.2667	-.4119	-.6011	-.8139	-1.0367	-1.5131						
A4	NA	.1672	.1623	.2029	.2865	.3953	.5192	.6495	.9221						
A5	NA	.0751	.0559	.0440	.0266	.0095	-.0030	-.0147	-.0553						
B1	NA	.0033	.0033	.0033	.0033	.0033	.0033	.0033	.0033						
B2	NA	-1.2520	-1.2520	-1.2520	-1.2520	-1.2520	-1.2520	-1.2520	-1.2520						
B3	NA	.8178	.8177	.8178	.8178	.8178	.8178	.8178	.8177						
B4	NA	.7328	.7328	.7328	.7328	.7328	.7328	.7328	.7328						
B5	NA	-1.3191	-1.3191	-1.3191	-1.3191	-1.3191	-1.3191	-1.3191	-1.3191						
TOTAL ANNUAL TRANSMITTED RADIATION															
DUE SOUTH AND VERTICAL					QTA1 = 374583	QTA2 = 311531					QTA3 = 267275				
AZIMUTH AND TILT COEF.					C1 = .0013	C2 = -.2062	C3 = -.5767	C4 = 1.9426	C5 = -1.3888						
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
TAVE:	45	50	58	60	74	85	90	86	80	65	53	43			
QHOR:	891	1294	1691	2256	2561	2756	2636	2412	2010	1470	1027	845			

DAGGETT, CALIFORNIA										ELEVATION = 1929					LAT = 34.9
SOUTH-VERT. (M=1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80					
VT1/DD	NA	839.32	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)					
VT2/DD	NA	717.93	364.59	202.64	127.15	87.64	64.97	51.10	35.53						
VT3/DD	NA	623.86	271.43	150.86	94.66	65.25	48.37	38.04	26.45						
MONTHLY DD	3	44	99	178	284	412	556	706	1016						
ANNUAL DD	6	101	252	516	950	1585	2405	3393	5846						
PARAMETER A	NA	.254	.403	.508	.594	.614	.606	.585	.532						
AZIMUTH AND TILT COEF.															
A1	NA	.0936	-.0672	-.0570	-.0527	-.0535	-.0552	-.0572	-.0616						
A2	NA	-.1497	.2110	.2690	.3782	.5443	.7275	.9238	1.3754						
A3	NA	.0656	-.1611	-.2437	-.3919	-.6124	-.8547	-1.1177	-1.7359						
A4	NA	-.1418	.1736	.2105	.2884	.4111	.5466	.6934	1.0351						
A5	NA	-.0435	.0299	.0205	.0041	-.0196	-.0446	-.0742	-.1496						
B1	NA	.0065	.0357	.0357	.0357	.0357	.0357	.0357	.0357						
B2	NA	-1.1856	-1.2292	-1.2292	-1.2292	-1.2292	-1.2292	-1.2292	-1.2292						
B3	NA	.7320	.7950	.7950	.7950	.7950	.7950	.7950	.7950						
B4	NA	.8468	.7594	.7594	.7594	.7594	.7594	.7594	.7594						
B5	NA	-1.3303	-1.3151	-1.3151	-1.3151	-1.3151	-1.3151	-1.3151	-1.3151						
TOTAL ANNUAL TRANSMITTED RADIATION															
DUE SOUTH AND VERTICAL					QTA1 = 375300	QTA2 = 312128					QTA3 = 267824				
AZIMUTH AND TILT COEF.					C1 = .0145	C2 = -.1935	C3 = -.5929	C4 = 1.9615	C5 = -1.3828						
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
TAVE:	47	53	57	62	73	79	89	85	79	66	56	47			
QHOR:	964	1305	1749	2268	2617	2748	2640	2370	2017	1518	1072	860			

EL TORO, CALIFORNIA										ELEVATION = 381					LAT = 33.7
SOUTH-VERT. (M=1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80					
VT1/DD	NA	NA	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=5)	(M=5)					
VT2/DD	NA	NA	2671.76	746.45	637.67	268.13	139.47	87.40	54.20	28.38					
VT3/DD	NA	NA	1982.91	554.00	232.95	121.19	75.94	45.82	23.99						
MONTHLY DD	0	1	14	49	116	209	334	309	590						
ANNUAL DD	0	2	31	153	482	1149	2196	3558	6800						
PARAMETER A	NA	NA	.420	.517	.492	.386	.324	.433	.504						
AZIMUTH AND TILT COEF.															
A1	NA	NA	.0084	.0014	-.0204	-.0941	-.1435	.2893	.2266						
A2	NA	NA	-.0292	.2419	.8524	1.9676	2.8167	-4.8995	-3.7764						
A3	NA	NA	.0238	-.2939	-1.0814	-2.4043	-3.4833	6.5202	4.9481						
A4	NA	NA	-.0157	.1729	.6095	1.4083	2.0324	-3.4731	-2.5977						
A5	NA	NA	.0026	-.0041	-.0482	-.0817	-.1285	.2575	.0945						
B1	NA	NA	-.0283	-.0283	-.0283	-.0182	-.0182	-.2783	.2783						
B2	NA	NA	-1.1296	-1.1297	-1.1297	-1.1864	-1.1864	.8918	.8918						
B3	NA	NA	.6766	.6766	.6766	.7583	.7583	-1.8295	-1.8295						
B4	NA	NA	.8880	.8880	.8880	.8051	.8052	3.0757	3.0756						
B5	NA	NA	-1.3301	-1.3301	-1.3301	-1.3046	-1.3046	-1.0375	-1.0374						
TOTAL ANNUAL TRANSMITTED RADIATION															
DUE SOUTH AND VERTICAL					QTA1 = 337351	QTA2 = 280994					QTA3 = 241414				
AZIMUTH AND TILT COEF.					C1 = -.1197	C2 = -.3156	C3 = -.3884	C4 = 1.8600	C5 = -1.2915						
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
TAVE:	54	56	56	58	61	63	69	70	70	62	59	54			
QHOR:	993	1233	1627	1923	2114	2225	2370	2144	1720	1375	1039	873			

FRESNO, CALIFORNIA												
ELEVATION = 328												
LAT = 36.8												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	NA	324.60	144.13	79.68	50.41	36.24	28.17	23.03	16.88			
VT2/DD	NA	277.06	123.03	68.01	43.03	30.93	24.04	19.66	14.41			
VT3/DD	NA	240.56	106.82	59.05	37.36	26.86	20.88	17.07	12.51			
MONTHLY DD	1	60	136	246	389	540	695	850	1160			
ANNUAL DD	2	127	343	741	1356	2171	3172	4343	7116			
PARAMETER A	NA	.650	.715	.787	.868	.919	.953	.976	.990			
AZIMUTH AND TILT COEF.												
A1	NA	.0087	.0094	.0125	.0160	.0193	.0217	.0235	.0265			
A2	NA	.0873	.0868	.1062	.1427	.1933	.2477	.3031	.4279			
A3	NA	-.0645	-.0692	-.1052	-.1646	-.2431	-.3266	-.4122	-.6067			
A4	NA	.0981	.1015	.1246	.1595	.2060	.2547	.3037	.4155			
A5	NA	-.0086	-.0141	-.0285	-.0451	-.0648	-.0847	-.1048	-.1519			
B1	NA	-.0540	-.0540	-.0540	-.0540	-.0540	-.0540	-.0540	-.0540			
B2	NA	-1.0399	-1.0399	-1.0399	-1.0399	-1.0399	-1.0399	-1.0399	-1.0399			
B3	NA	.6858	.6858	.6858	.6858	.6858	.6858	.6858	.6858			
B4	NA	.7490	.7489	.7489	.7489	.7489	.7489	.7489	.7489			
B5	NA	-1.1593	-1.1593	-1.1593	-1.1593	-1.1593	-1.1592	-1.1593	-1.1593			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	43	49	55	59	68	76	81	78	72	63	51	42
QHOR:	669	1033	1590	2116	2502	2720	2708	2399	2024	1455	911	570

LOS ANGELES, CALIFORNIA												
ELEVATION = 105												
LAT = 33.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	NA	NA	NA	1366.86	452.04	198.15	113.84	75.26	38.84			
VT2/DD	NA	NA	NA	1169.57	386.79	169.55	94.86	61.11	31.33			
VT3/DD	NA	NA	NA	1016.27	336.09	147.33	81.68	51.78	26.48			
MONTHLY DD	0	1	6	25	74	169	288	328	539			
ANNUAL DD	0	1	7	45	240	818	1851	3300	6793			
PARAMETER A	NA	NA	NA	.742	.632	.418	.359	.350	.362			
AZIMUTH AND TILT COEF.												
A1	NA	NA	NA	.0064	.0198	.0119	.1719	.0110	.3939			
A2	NA	NA	NA	.1822	.6147	1.5103	-1.1159	-3.8450	-5.6262			
A3	NA	NA	NA	-.2137	-.6587	-1.7128	1.0635	4.9619	7.5059			
A4	NA	NA	NA	.1457	.4473	1.0934	-.7835	-2.7267	-4.0269			
A5	NA	NA	NA	-.0165	.0088	-.0122	-.0926	.2816	.3383			
B1	NA	NA	NA	-.0325	-.0325	-.0325	-.1130	-.1048	-.2943			
B2	NA	NA	NA	-1.1809	-1.1809	-1.1809	-.4665	.2276	.9025			
B3	NA	NA	NA	.7501	.7502	.7501	-.2104	-1.1320	-1.8509			
B4	NA	NA	NA	.7940	.7940	.7940	1.7020	2.4436	3.0884			
B5	NA	NA	NA	-1.2992	-1.2992	-1.2991	-1.3865	-1.3456	-1.0532			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	56	55	55	59	62	64	67	69	67	63	59	56
QHOR:	943	1230	1642	1909	2133	2127	2294	2123	1761	1305	998	853

MOUNT SHASTA, CALIFORNIA												
ELEVATION = 3586												
LAT = 41.3												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	668.00	99.18	60.06	42.37	32.70	26.63	22.45	19.41	15.27			
VT2/DD	571.01	84.78	51.34	36.22	27.96	22.76	19.19	16.59	13.06			
VT3/DD	495.97	73.63	44.60	31.46	24.28	19.77	16.67	14.41	11.34			
MONTHLY DD	33	224	370	524	679	834	989	1144	1454			
ANNUAL DD	70	656	1299	2170	3216	4434	5809	7314	10627			
PARAMETER A	.426	.768	.802	.792	.774	.769	.767	.758	.723			
AZIMUTH AND TILT COEF.												
A1	-.1112	-.0575	-.0635	-.0716	-.0772	-.0786	-.0786	-.0789	-.0817			
A2	.1134	.0471	.1120	.2203	.3133	.4013	.4897	.5867	.8038			
A3	-.0914	-.0670	-.1606	-.2804	-.3956	-.5130	-.6366	-.7741	-1.0829			
A4	.1142	.0667	.1265	.2048	.2796	.3527	.4285	.5129	.7043			
A5	.0008	-.0210	-.0293	-.0383	-.0487	-.0655	-.0874	-.1133	-.1727			
B1	.0318	.0318	.0318	.0318	.0318	.0318	.0318	.0318	.0318			
B2	-1.0813	-1.0813	-1.0813	-1.0813	-1.0813	-1.0813	-1.0813	-1.0813	-1.0813			
B3	.7077	.7076	.7076	.7076	.7077	.7076	.7077	.7076	.7076			
B4	.6799	.6799	.6799	.6799	.6799	.6799	.6799	.6799	.6799			
B5	-1.2063	-1.2062	-1.2063	-1.2063	-1.2063	-1.2062	-1.2063	-1.2063	-1.2063			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	33	38	44	46	55	63	71	68	63	49	42	35
QHOR:	569	799	1309	1779	2199	2481	2602	2234	1786	1168	599	528

OAKLAND, CALIFORNIA												
ELEVATION = 7												
LAT = 37.7												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	NA	645.84	215.94	105.21	64.07	45.17	34.86	23.93			
VT2/DD	NA	NA	551.56	184.41	89.85	54.71	38.58	29.77	20.43			
VT3/DD	NA	NA	479.02	160.16	78.03	47.52	33.51	25.85	17.75			
MONTHLY DD	0	4	37	110	225	369	524	679	989			
ANNUAL DD	0	6	60	245	741	1734	3215	4918	8520			
PARAMETER A	NA	NA	.600	.814	.899	.874	.819	.713	.539			
AZIMUTH AND TILT COEF.												
A1	NA	NA	.0460	.0508	.0608	.0654	.0636	.0662	.0763			
A2	NA	NA	-.0969	-.0516	.1326	.3982	.7052	1.0686	1.7529			
A3	NA	NA	.0582	.0116	-.2093	-.5709	-1.0103	-1.5190	-2.4389			
A4	NA	NA	-.0317	.0032	.1438	.3651	.6348	.9531	1.5387			
A5	NA	NA	-.0471	-.0468	-.0612	-.1164	-.1981	-.2833	-.4070			
B1	NA	NA	-.0825	-.0825	-.0825	-.0825	-.0825	-.0825	-.0825			
B2	NA	NA	-1.0789	-1.0789	-1.0789	-1.0789	-1.0789	-1.0789	-1.0789			
B3	NA	NA	.6893	.6893	.6893	.6893	.6893	.6893	.6893			
B4	NA	NA	.7903	.7903	.7903	.7903	.7903	.7903	.7903			
B5	NA	NA	-1.2231	-1.2231	-1.2231	-1.2231	-1.2231	-1.2231	-1.2231			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 313023 QTA2 = 260250 QTA3 = 223289												
AZIMUTH AND TILT COEF. C1 = -.1003 C2 = -.2861 C3 = -.4195 C4 = 1.8449 C5 = -1.2944												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	48	52	52	54	58	60	61	63	63	60	54	49
QHOR:	665	1002	1359	1974	2209	2348	2286	2087	1679	1190	786	643

POINT MUGU, CALIFORNIA												
ELEVATION = 13												
LAT = 34.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 3)	(M= 3)	(M= 3)	(M= 3)	(M= 5)	(M= 5)			
VT1/DD	NA	NA	2549.57	724.92	311.54	151.88	91.56	56.68	30.58			
VT2/DD	NA	NA	2182.62	620.59	259.10	126.32	76.15	45.72	24.67			
VT3/DD	NA	NA	1896.71	539.29	222.84	108.64	65.49	38.63	20.85			
MONTHLY DD	0	1	13	47	103	210	349	363	673			
ANNUAL DD	0	3	38	177	524	1237	2430	4006	7568			
PARAMETER A	NA	NA	.460	.545	.515	.528	.433	.527	.537			
AZIMUTH AND TILT COEF.												
A1	NA	NA	-.0272	-.0206	-.0268	-.0484	-.0983	.1294	.0973			
A2	NA	NA	.8697	.9373	-1.4775	-.9736	-.6432	-3.8500	-3.5354			
A3	NA	NA	-.9472	-1.0368	1.6150	.9862	.5316	5.1133	4.6610			
A4	NA	NA	.5661	.6139	-.8885	-.5502	-.3051	-2.5533	-2.2981			
A5	NA	NA	.0532	.0449	-.1395	-.1396	-.1566	-.0839	-.0249			
B1	NA	NA	-.0063	-.0063	-.0121	-.0121	-.0121	-.1801	-.1801			
B2	NA	NA	-1.2047	-1.2047	-.3867	-.3867	-.3867	.9472	.9472			
B3	NA	NA	.7735	.7734	-.3150	-.3150	-.3150	-1.9257	-1.9258			
B4	NA	NA	.7851	.7852	1.7196	1.7195	1.7196	3.0157	3.0158			
B5	NA	NA	-1.3111	-1.3111	-1.3741	-1.3740	-1.3741	-1.0416	-1.0416			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 330564 QTA2 = 275614 QTA3 = 236916												
AZIMUTH AND TILT COEF. C1 = -.0993 C2 = -.3222 C3 = -.3542 C4 = 1.7759 C5 = -1.2672												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	54	54	53	57	58	61	64	65	65	62	57	55
QHOR:	918	1224	1636	2028	2074	2033	2206	1896	1601	1291	1017	649

RED BLUFF, CALIFORNIA												
ELEVATION = 354												
LAT = 40.2												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)			
VT1/DD	NA	264.27	132.71	78.03	52.77	39.12	30.75	24.81	17.89			
VT2/DD	NA	226.03	113.51	66.74	45.13	33.46	26.30	21.24	15.32			
VT3/DD	NA	196.33	98.59	57.97	39.20	29.07	22.84	18.46	13.31			
MONTHLY DD	5	81	162	276	408	550	700	802	1112			
ANNUAL DD	5	137	378	817	1455	2277	3277	4453	7254			
PARAMETER A	NA	.714	.767	.762	.740	.737	.749	.790	.837			
AZIMUTH AND TILT COEF.												
A1	NA	-.0037	-.0036	-.0006	.0022	.0049	.0073	.0304	.0314			
A2	NA	-.0101	-.0288	.1144	.2131	.3027	.3803	.5203	.6258			
A3	NA	-.0038	-.0567	-.1550	-.2718	-.3845	-.4869	-.6155	-.7831			
A4	NA	-.0076	.0229	.0885	.1630	.2321	.2932	.4201	.5110			
A5	NA	-.0103	-.0186	-.0236	-.0303	-.0409	-.0535	-.0482	-.0877			
B1	NA	-.0352	-.0352	-.0352	-.0352	-.0352	-.0352	-.0456	-.0456			
B2	NA	-1.1386	-1.1386	-1.1386	-1.1386	-1.1386	-1.1386	-1.1735	-1.1736			
B3	NA	.7692	.7691	.7691	.7691	.7691	.7691	.8157	.8157			
B4	NA	.7118	.7119	.7118	.7119	.7119	.7118	.6443	.6443			
B5	NA	-1.2027	-1.2027	-1.2027	-1.2027	-1.2027	-1.2027	-1.1953	-1.1953			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 328888 QTA2 = 273310 QTA3 = 234377												
AZIMUTH AND TILT COEF. C1 = -.0210 C2 = -.1954 C3 = -.5323 C4 = 1.8505 C5 = -1.3437												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	42	49	50	51	67	77	82	80	73	63	51	44
QHOR:	569	866	1318	1953	2338	2542	2686	2350	1855	1251	736	492

SAN DIEGO CA TMY										ELEVATION = 30					LAT = 32.7				
SOUTH-VERT. (M= 1)										(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 5)				
VT1/DD	NA	NA	NA	1949.55	549.07	216.38	112.92	74.14	38.34										
VT2/DD	NA	NA	NA	1663.20	468.42	184.60	96.34	63.25	31.00										
VT3/DD	NA	NA	NA	1444.62	406.86	160.34	83.68	54.94	26.25										
MONTHLY DD	0	0	2	17	60	152	291	444	514										
ANNUAL DD	0	0	3	31	159	572	1460	2826	6281										
PARAMETER A	NA	NA	NA	.376	.601	.536	.458	.385	.434										
AZIMUTH AND TILT COEF.																			
A1	NA	NA	NA	-.0014	-.0284	-.0757	-.1202	-.1734	.0947										
A2	NA	NA	NA	-.1340	.1497	.6549	1.2936	2.0243	-4.3534										
A3	NA	NA	NA	.0863	-.2366	-.8528	-1.6906	-2.6346	5.7182										
A4	NA	NA	NA	-.0473	.1568	.5436	1.0312	1.5700	-2.9249										
A5	NA	NA	NA	-.0570	-.0625	-.0944	-.1497	-.1789	.0932										
B1	NA	NA	NA	-.0177	-.0177	-.0177	-.0177	-.0177	-.2223										
B2	NA	NA	NA	-1.0743	-1.0743	-1.0743	-1.0743	-1.0743	.8596										
B3	NA	NA	NA	.6272	.6272	.6272	.6272	.6272	-1.7581										
B4	NA	NA	NA	.9253	.9253	.9253	.9253	.9253	3.0159										
B5	NA	NA	NA	-1.3064	-1.3064	-1.3064	-1.3064	-1.3064	-1.0003										
TOTAL ANNUAL TRANSMITTED RADIATION																			
DUE SOUTH AND VERTICAL										QTA1 = 326323			QTA2 = 271836			QTA3 = 233615			
AZIMUTH AND TILT COEF.										C1 = -.1403		C2 = -.3271		C3 = -.3550		C4 = 1.8486		C5 = -1.2694	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC							
TAVE:	55	57	58	60	63	64	68	70	70	66	61	57							
QHOR:	959	1280	1617	1920	1996	2003	2191	2106	1694	1385	1064	882							

SAN FRANCISCO, CALIFORNIA										ELEVATION = 16					LAT = 37.6				
SOUTH-VERT. (M= 1)										(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)				
VT1/DD	NA	NA	NA	566.75	212.87	107.91	66.89	47.18	24.82										
VT2/DD	NA	NA	NA	484.11	181.83	92.17	57.14	40.30	21.20										
VT3/DD	NA	NA	NA	420.45	157.92	80.05	49.63	35.00	18.41										
MONTHLY DD	0	5	43	114	226	364	516	671	981										
ANNUAL DD	0	11	90	331	982	2175	3703	5395	8974										
PARAMETER A	NA	NA	.681	.829	.864	.816	.710	.611	.469										
AZIMUTH AND TILT COEF.																			
A1	NA	NA	.0208	.0266	.0344	.0399	.0453	.0506	.0612										
A2	NA	NA	-.0630	.0949	.3746	.6838	1.0556	1.4418	2.1527										
A3	NA	NA	.0241	-.1636	-.5456	-.9905	-1.5160	-2.0471	-2.9991										
A4	NA	NA	-.0185	.1003	.3322	.6044	.9296	1.2611	1.8615										
A5	NA	NA	-.0362	-.0465	-.1050	-.1907	-.2829	-.3633	-.4863										
B1	NA	NA	-.0665	-.0665	-.0665	-.0665	-.0665	-.0665	-.0665										
B2	NA	NA	-1.0915	-1.0915	-1.0915	-1.0915	-1.0915	-1.0915	-1.0915										
B3	NA	NA	.6990	.6990	.6990	.6990	.6990	.6990	.6990										
B4	NA	NA	.7935	.7935	.7935	.7935	.7935	.7935	.7935										
B5	NA	NA	-1.2317	-1.2317	-1.2317	-1.2317	-1.2317	-1.2317	-1.2317										
TOTAL ANNUAL TRANSMITTED RADIATION																			
DUE SOUTH AND VERTICAL										QTA1 = 325986			QTA2 = 271087			QTA3 = 232596			
AZIMUTH AND TILT COEF.										C1 = -.0768		C2 = -.2904		C3 = -.4324		C4 = 1.8576		C5 = -1.3182	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC							
TAVE:	48	51	51	54	55	58	60	61	62	59	53	48							
QHOR:	679	1077	1417	1946	2249	2440	2427	2098	1777	1225	894	616							

SANTA MARIA, CALIFORNIA										ELEVATION = 236					LAT = 34.9				
SOUTH-VERT. (M= 1)										(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 6)				
VT1/DD	NA	820.17	400.35	226.71	134.32	86.50	61.48	46.38	26.73										
VT2/DD	NA	700.70	342.04	193.69	114.75	73.90	52.53	37.38	21.54										
VT3/DD	NA	608.65	297.10	168.24	99.68	64.19	45.62	31.63	18.23										
MONTHLY DD	2	38	77	136	230	358	503	407	707										
ANNUAL DD	3	72	192	467	1113	2253	3700	5350	8902										
PARAMETER A	NA	.515	.720	.750	.720	.579	.418	.400	.474										
AZIMUTH AND TILT COEF.																			
A1	NA	-.0179	-.0090	-.0114	-.0246	-.0583	-.1078	.1208	.0882										
A2	NA	.0126	-.1430	-.3660	-.8201	1.5203	2.4448	-6.1518	-4.8643										
A3	NA	-.0614	-.1998	-.4958	-1.1367	-2.0997	-3.3200	8.6883	6.8033										
A4	NA	.0187	.1182	.2939	.6663	1.2372	1.9705	-5.0303	-3.9337										
A5	NA	-.0316	-.0275	-.0584	-.1494	-.2658	-.3709	.9835	.9931										
B1	NA	-.0144	-.0144	-.0144	-.0144	-.0144	-.0144	-.2136	-.2136										
B2	NA	-1.1221	-1.1221	-1.1221	-1.1221	-1.1221	-1.1221	1.3694	1.3695										
B3	NA	.7156	.7156	.7156	.7156	.7156	.7156	-2.4938	-2.4940										
B4	NA	.8408	.8408	.8408	.8408	.8408	.8408	3.7916	3.7917										
B5	NA	-1.2919	-1.2919	-1.2919	-1.2919	-1.2919	-1.2919	-.9217	-.9219										
TOTAL ANNUAL TRANSMITTED RADIATION																			
DUE SOUTH AND VERTICAL										QTA1 = 325546			QTA2 = 270853			QTA3 = 232533			
AZIMUTH AND TILT COEF.										C1 = -.1077		C2 = -.2901		C3 = -.4187		C4 = 1.8874		C5 = -1.3046	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC							
TAVE:	48	51	52	54	56	56	60	60	60	58	55	51							
QHOR:	843	1101	1549	1920	2044	2394	2369	2109	1689	1366	958	802							

SUNNYVALE, CALIFORNIA

ELEVATION = 39

LAT = 37.4

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)
VT1/DD	NA	NA	614.36	270.05	130.86	75.13	51.26	38.74	26.02
VT2/DD	NA	NA	525.69	231.07	111.97	64.29	43.87	33.15	22.27
VT3/DD	NA	NA	456.68	200.74	97.27	55.85	38.11	28.80	19.34
MONTHLY DD	0	11	40	91	188	327	479	634	944
ANNUAL DD	0	18	97	323	831	1730	3034	4612	8136
PARAMETER A	NA	NA	.871	.717	.647	.697	.717	.665	.521
AZIMUTH AND TILT COEF.									
A1	NA	NA	.0289	.0473	.0523	.0407	.0295	.0213	.0096
A2	NA	NA	.1509	.3921	.6099	.7058	.8955	1.2265	2.0052
A3	NA	NA	-.1590	-.4316	-.7034	-.8637	-1.1592	-1.6368	-2.6912
A4	NA	NA	.1083	.2843	.4529	.5465	.7231	1.0138	1.6668
A5	NA	NA	.0035	-.0011	-.0237	-.0688	-.1405	-.2308	-.3768
B1	NA	NA	-.0381	-.0381	-.0381	-.0381	-.0381	-.0381	-.0381
B2	NA	NA	-1.1628	-1.1628	-1.1628	-1.1628	-1.1628	-1.1628	-1.1628
B3	NA	NA	.7857	.7858	.7858	.7858	.7858	.7858	.7858
B4	NA	NA	.7158	.7158	.7158	.7158	.7158	.7158	.7158
B5	NA	NA	-1.2246	-1.2246	-1.2246	-1.2246	-1.2246	-1.2246	-1.2246

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL		AZIMUTH AND TILT COEF.			AZIMUTH AND TILT COEF.			AZIMUTH AND TILT COEF.				
QTA1 = 323128		C1 = -.0780			C2 = -.2648			C3 = -.4592				
C4 = 1.8779		C5 = -1.3070			C6 = 1.8779			C7 = -1.3070				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	49	51	53	57	59	64	64	65	63	61	53	49
QHOR:	737	1043	1467	1896	2301	2433	2447	2197	1751	1239	844	634

COLORADO SPRINGS, COLORADO

ELEVATION = 6171

LAT = 38.8

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=2)	(M=2)	(M=2)	(M=3)	(M=3)	(M=4)
VT1/DD	293.83	123.39	91.14	71.04	56.98	47.23	40.59	34.63	26.82
VT2/DD	251.68	105.69	78.06	60.39	48.44	40.15	33.90	28.92	21.88
VT3/DD	218.74	91.86	67.85	52.39	42.02	34.83	29.19	24.91	18.60
MONTHLY DD	147	350	474	522	651	786	901	1056	1013
ANNUAL DD	459	1414	2097	2932	3934	5097	6440	7936	11244
PARAMETER A	.494	.337	.311	.309	.314	.314	.326	.340	.336
AZIMUTH AND TILT COEF.									
A1	.0451	.0870	.1031	.0304	.0412	.0528	.1015	.1119	-.3218
A2	.6498	1.1919	1.4119	.0613	.2634	.4796	-2.0843	-1.7046	-5.0829
A3	-.6326	-1.2172	-1.4723	-.4395	-.6783	-.9405	-1.9826	-1.5413	6.2182
A4	.4195	.7798	.9304	.0530	.2072	.3749	-.9970	-.7300	-3.2101
A5	.1149	.1680	.1755	-.1988	-.2061	-.2180	-.3976	-.3962	-.0474
B1	-.0269	-.0269	-.0269	-.0129	-.0129	-.0129	-.0223	-.0223	-.1169
B2	-1.1664	-1.1664	-1.1665	-.9266	-.9266	-.9266	-.3737	-.3737	-.3681
B3	.7373	.7373	.7373	.4096	.4096	.4096	-.2979	-.2979	-1.2709
B4	.6658	.6659	.6659	.9832	.9832	.9832	1.5143	1.5143	2.3201
B5	-1.3518	-1.3519	-1.3518	-1.4009	-1.4009	-1.4009	-1.4664	-1.4664	-1.4699

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL		AZIMUTH AND TILT COEF.			AZIMUTH AND TILT COEF.			AZIMUTH AND TILT COEF.				
QTA1 = 389705		C1 = .0510			C2 = -.3640			C3 = -.3178				
C4 = 1.6205		C5 = -1.3902			C6 = 1.6205			C7 = -1.3902				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	30	32	35	46	55	65	70	69	62	52	37	33
QHOR:	884	1164	1590	1956	2146	2344	2177	2022	1779	1389	972	760

DENVER, COLORADO

ELEVATION = 5331

LAT = 39.8

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=2)	(M=2)	(M=2)	(M=2)	(M=2)	(M=2)
VT1/DD	213.04	103.97	78.45	61.97	49.91	41.50	35.41	30.88	24.58
VT2/DD	182.55	89.10	67.22	52.68	42.43	35.28	30.11	26.25	20.90
VT3/DD	158.67	77.44	58.43	45.70	36.80	30.60	26.11	22.77	18.13
MONTHLY DD	193	396	525	545	677	814	954	1094	1374
ANNUAL DD	568	1510	2209	3059	4059	5223	6542	8004	11262
PARAMETER A	.492	.428	.417	.418	.430	.438	.438	.430	.375
AZIMUTH AND TILT COEF.									
A1	.0459	.0864	.1028	.0336	.0438	.0536	.0634	.0741	.1059
A2	.4113	.6545	.7883	-.3182	-.1620	.0157	.2016	.4021	.9085
A3	-.3867	-.6345	-.7878	.0130	-.1582	-.3669	-.5935	-.8479	-1.5254
A4	.2766	.4408	.5374	-.0971	.0126	.1428	.2821	.4364	.8402
A5	.0877	.1158	.1152	-.2401	-.2361	-.2414	-.2522	-.2705	-.3389
B1	-.0366	-.0366	-.0366	-.0178	-.0178	-.0178	-.0178	-.0178	-.0178
B2	-1.1883	-1.1883	-1.1883	-.9252	-.9253	-.9253	-.9252	-.9253	-.9252
B3	.7562	.7562	.7562	.4242	.4242	.4242	.4242	.4242	.4242
B4	.6544	.6544	.6545	.9707	.9707	.9707	.9707	.9707	.9706
B5	-1.3439	-1.3440	-1.3440	-1.3722	-1.3722	-1.3722	-1.3722	-1.3722	-1.3721

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL		AZIMUTH AND TILT COEF.			AZIMUTH AND TILT COEF.			AZIMUTH AND TILT COEF.				
QTA1 = 386992		C1 = .0505			C2 = -.3776			C3 = -.3051				
C4 = 1.6205		C5 = -1.3879			C6 = 1.6205			C7 = -1.3879				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	29	30	38	48	57	64	72	70	62	49	38	30
QHOR:	834	1080	1609	1910	2206	2345	2325	2015	1777	1339	881	744

EAGLE, COLORADO

EAGLE, COLORADO												
ELEVATION = 6512												
LAT = 39.7												
	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	92.08	53.69	43.30	36.08	30.92	27.06	24.05	21.64	18.03			
VT2/DD	78.81	46.07	37.06	30.88	26.47	23.16	20.58	18.52	15.43			
VT3/DD	68.48	40.05	32.20	26.83	23.00	20.12	17.88	16.09	13.41			
MONTHLY DD	364	670	774	929	1084	1239	1394	1549	1859			
ANNUAL DD	1251	2666	3622	4729	5976	7352	8839	10421	13824			
PARAMETER A	.509	.569	.586	.598	.603	.597	.579	.552	.479			
AZIMUTH AND TILT COEF.												
A1	-.0472	.0118	-.0398	-.0367	-.0340	-.0315	-.0293	-.0272	-.0230			
A2	-.0595	.7273	-.3750	.4863	.6058	.7437	.9075	1.1031	1.5882			
A3	-.0928	-.6846	-.4486	-.5912	-.7497	-.9359	-1.1580	-1.4214	-2.0628			
A4	-.1643	.4138	.3826	.4663	.5587	.6682	.8007	.9597	1.3530			
A5	-.0451	.1136	-.0425	-.0543	-.0710	-.0930	-.1204	-.1513	-.2165			
B1	.0385	.0182	.0385	.0385	.0385	.0385	.0385	.0385	.0385			
B2	-1.1306	-1.2569	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306			
B3	.7257	.8581	.7257	.7257	.7258	.7257	.7257	.7257	.7257			
B4	.6679	.5936	.6679	.6679	.6679	.6679	.6679	.6679	.6679			
B5	-1.3018	-1.3062	-1.3018	-1.3018	-1.3018	-1.3018	-1.3019	-1.3018	-1.3019			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	20	22	31	42	51	59	65	64	54	42	31	18
QHOR:	744	1120	1479	2004	2269	2510	2334	2115	1761	1296	914	705

GRAND JUNCTION, COLORADO

GRAND JUNCTION, COLORADO												
ELEVATION = 4839												
LAT = 39.1												
	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	164.23	69.32	52.97	42.81	35.92	30.94	27.17	24.22	19.90			
VT2/DD	140.54	59.31	45.33	36.63	30.74	26.48	23.25	20.73	17.03			
VT3/DD	122.11	51.54	39.38	31.83	26.71	23.00	20.20	18.01	14.80			
MONTHLY DD	211	499	653	808	963	1118	1273	1428	1738			
ANNUAL DD	470	1397	2076	2890	3820	4870	6040	7347	10373			
PARAMETER A	.650	.703	.693	.677	.657	.639	.624	.614	.592			
AZIMUTH AND TILT COEF.												
A1	.0341	.0241	.0222	.0210	.0203	.0197	.0194	.0193	.0207			
A2	-.0233	.1090	.1897	.2797	.3765	.4788	.5827	.6881	.9360			
A3	-.0155	-.1330	-.2169	-.3182	-.4315	-.5543	-.6834	-.8198	-1.1589			
A4	.0350	.1221	.1795	.2452	.3176	.3951	.4757	.5593	.7641			
A5	-.0385	-.0140	-.0077	-.0063	-.0080	-.0125	-.0208	-.0341	-.0819			
B1	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002			
B2	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306	-1.1306			
B3	.7119	.7119	.7119	.7119	.7119	.7119	.7119	.7119	.7119			
B4	.6905	.6905	.6905	.6905	.6905	.6905	.6904	.6905	.6905			
B5	-1.3112	-1.3112	-1.3112	-1.3112	-1.3112	-1.3111	-1.3112	-1.3112	-1.3112			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	23	32	39	50	63	72	79	76	66	52	39	29
QHOR:	777	1103	1523	1959	2397	2582	2508	2199	1821	1328	924	731

PUEBLO, COLORADO

PUEBLO, COLORADO												
ELEVATION = 4721												
LAT = 38.3												
	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	169.14	88.77	69.00	55.80	46.50	39.70	34.51	30.50	24.74			
VT2/DD	144.83	76.01	59.08	47.78	39.82	33.99	29.54	26.11	21.19			
VT3/DD	125.86	66.06	51.35	41.52	34.60	29.54	25.68	22.69	18.41			
MONTHLY DD	240	458	589	729	875	1025	1179	1334	1644			
ANNUAL DD	640	1449	2035	2755	3614	4613	5774	7107	10155			
PARAMETER A	.583	.584	.578	.565	.555	.541	.528	.512	.447			
AZIMUTH AND TILT COEF.												
A1	.0650	.0702	.0746	.0800	.0852	.0914	.0972	.1042	.1300			
A2	.5422	.5485	.5883	.6583	.7484	.8646	.9954	1.1564	1.6634			
A3	-.5582	-.5657	-.6136	-.7010	-.8157	-.9641	-1.1345	-1.3470	-2.0126			
A4	.3591	.3645	.3935	.4452	.5124	.5997	.7001	.8259	1.2240			
A5	.0590	.0611	.0600	.0559	.0486	.0383	.0235	.0025	-.0619			
B1	-.0262	-.0262	-.0262	-.0262	-.0262	-.0262	-.0262	-.0262	-.0262			
B2	-1.1626	-1.1626	-1.1626	-1.1626	-1.1626	-1.1626	-1.1626	-1.1626	-1.1626			
B3	.7257	.7257	.7258	.7258	.7257	.7258	.7257	.7257	.7258			
B4	.6979	.6979	.6979	.6979	.6979	.6979	.6979	.6979	.6979			
B5	-1.3490	-1.3490	-1.3491	-1.3490	-1.3491	-1.3490	-1.3491	-1.3491	-1.3490			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	26	34	38	50	62	71	75	74	65	56	42	34
QHOR:	869	1174	1612	1939	2225	2502	2312	2068	1742	1383	960	800

HARTFORD, CONNECTICUT												
ELEVATION = 180												
LAT = 41.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	83.09	34.75	25.39	19.73	16.04	13.48	11.61	10.20	8.20			
VT2/DD	71.01	29.70	21.70	16.87	13.71	11.52	9.92	8.72	7.01			
VT3/DD	61.67	25.79	18.84	14.65	11.90	10.01	8.62	7.57	6.08			
MONTHLY DD	156	373	510	657	808	961	1116	1270	1580			
ANNUAL DD	591	1549	2262	3115	4106	5232	6506	7927	11171			
PARAMETER A	.446	.636	.693	.753	.807	.851	.888	.921	.961			
AZIMUTH AND TILT COEF.												
A1	-.0655	-.0366	-.0297	-.0239	-.0196	-.0163	-.0138	-.0119	-.0089			
A2	.3403	.3318	.3456	.3518	.3622	.3783	.3965	.4172	.4813			
A3	-.3975	-.3769	-.3877	-.3955	-.4118	-.4362	-.4639	-.4958	-.5911			
A4	.3665	.3033	.2995	.2957	.2994	.3098	.3230	.3392	.3911			
A5	-.0967	-.0480	-.0351	-.0293	-.0289	-.0312	-.0349	-.0400	-.0554			
B1	.0019	.0019	.0019	.0019	.0019	.0019	.0019	.0019	.0019			
B2	-1.0835	-1.0835	-1.0835	-1.0835	-1.0835	-1.0835	-1.0835	-1.0835	-1.0835			
B3	.7642	.7642	.7642	.7642	.7642	.7642	.7642	.7642	.7642			
B4	.6338	.6337	.6337	.6337	.6337	.6337	.6337	.6337	.6337			
B5	-1.1120	-1.1119	-1.1119	-1.1120	-1.1120	-1.1119	-1.1119	-1.1120	-1.1119			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 236215	QTA2 = 197248			QTA3 = 169727					
AZIMUTH AND TILT COEF.			C1 = .0092	C2 = -.3189	C3 = -.2118	C4 = 1.5188	C5 = -1.1223					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	25	27	35	49	58	69	73	70	62	51	41	29
QHOR:	492	784	992	1304	1679	1681	1717	1421	1148	863	493	355

WILMINGTON, DELAWARE												
ELEVATION = 79												
LAT = 39.7												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	163.17	62.45	44.50	34.07	27.50	23.01	19.79	17.36	13.93			
VT2/DD	139.44	53.37	38.03	29.11	23.50	19.67	16.91	14.83	11.91			
VT3/DD	121.11	46.35	33.03	25.28	20.41	17.08	14.69	12.88	10.34			
MONTHLY DD	134	350	492	642	796	951	1106	1261	1571			
ANNUAL DD	257	902	1493	2239	3105	4094	5211	6493	9608			
PARAMETER A	.549	.626	.630	.616	.601	.594	.592	.598	.618			
AZIMUTH AND TILT COEF.												
A1	.0637	.0655	.0712	.0772	.0816	.0835	.0838	.0818	.0758			
A2	.2411	.2384	.3073	.3951	.4830	.5687	.6546	.7323	.8826			
A3	-.2115	-.2263	-.3053	-.4063	-.5101	-.6162	-.7253	-.8271	-1.0367			
A4	.1557	.1572	.2048	.2661	.3281	.3904	.4538	.5125	.6343			
A5	.0393	.0323	.0348	.0367	.0367	.0329	.0272	.0198	-.0064			
B1	-.0361	-.0361	-.0361	-.0361	-.0361	-.0361	-.0361	-.0361	-.0361			
B2	-1.0858	-1.0858	-1.0858	-1.0858	-1.0858	-1.0858	-1.0858	-1.0858	-1.0858			
B3	.7083	.7083	.7083	.7083	.7083	.7083	.7083	.7083	.7083			
B4	.7220	.7220	.7220	.7220	.7220	.7221	.7220	.7220	.7220			
B5	-1.2076	-1.2075	-1.2076	-1.2075	-1.2076	-1.2076	-1.2076	-1.2075	-1.2075			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 264220	QTA2 = 220473			QTA3 = 189602					
AZIMUTH AND TILT COEF.			C1 = -.0050	C2 = -.3291	C3 = -.2455	C4 = 1.5886	C5 = -1.1719					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	29	32	42	52	60	71	75	74	67	57	45	36
QHOR:	585	829	1112	1488	1667	1864	1860	1646	1335	1012	635	499

WASHINGTON, D.C.												
ELEVATION = 289												
LAT = 38.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)			
VT1/DD	160.14	68.86	49.64	37.84	30.41	25.31	21.63	18.81	14.44			
VT2/DD	136.84	58.84	42.42	32.33	25.98	21.63	18.48	16.09	12.35			
VT3/DD	118.84	51.10	36.84	28.08	22.56	18.79	16.05	13.98	10.73			
MONTHLY DD	144	334	464	608	757	909	1064	1226	1336			
ANNUAL DD	264	894	1430	2113	2930	3887	5004	6284	9372			
PARAMETER A	.560	.594	.557	.539	.536	.541	.554	.569	.627			
AZIMUTH AND TILT COEF.												
A1	-.0575	-.0929	-.1106	-.1209	-.1247	-.1247	-.1222	.0683	.0597			
A2	.2861	.3463	.4192	.4987	.5733	.6424	.7086	.7458	1.0488			
A3	-.2592	-.3434	-.4274	-.5212	-.6154	-.7073	-.8000	-1.0588	-1.2412			
A4	.1695	.2093	.2544	.3055	.3570	.4080	.4606	.5252	.6562			
A5	.0611	.0613	.0682	.0720	.0699	.0636	.0525	.0072	-.0376			
B1	.0543	.0543	.0543	.0543	.0543	.0543	.0543	-.0160	-.0160			
B2	-1.0893	-1.0893	-1.0893	-1.0893	-1.0893	-1.0893	-1.0893	-1.1356	-1.1356			
B3	.7192	.7192	.7192	.7192	.7192	.7193	.7192	.7807	.7807			
B4	.7408	.7408	.7409	.7408	.7408	.7408	.7409	.6713	.6713			
B5	-1.2365	-1.2364	-1.2364	-1.2364	-1.2364	-1.2364	-1.2365	-1.2044	-1.2045			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 261459	QTA2 = 217987			QTA3 = 187386					
AZIMUTH AND TILT COEF.			C1 = .0183	C2 = -.2857	C3 = -.2975	C4 = 1.6289	C5 = -1.1923					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	30	33	43	54	63	69	75	74	69	56	46	36
QHOR:	608	813	1180	1482	1711	1892	1716	1700	1313	983	676	489

APALACHICOLA, FLORIDA

										ELEVATION = 20		LAT = 29.7		
										TB55	TB60	TB65	TB70	TB80
										(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)
TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80						
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)						
VT1/DD	NA	1411.91	576.32	285.04	160.41	99.62	66.60	47.90	30.18					
VT2/DD	NA	1200.17	489.89	242.29	136.35	84.68	56.61	40.72	25.66					
VT3/DD	NA	1041.68	425.20	210.30	118.35	73.50	49.13	35.34	22.27					
MONTHLY DD	1	18	44	89	157	253	379	527	836					
ANNUAL DD	1	37	112	265	524	932	1534	2342	4620					
PARAMETER A	NA	.718	.675	.577	.520	.515	.531	.545	.577					
AZIMUTH AND TILT COEF.														
A1	NA	.0172	.0209	.0280	.0331	.0337	.0327	.0317	.0281					
A2	NA	.1080	.0961	.1238	.1694	.2265	.2944	.3931	.6608					
A3	NA	-.1585	-.1627	-.2168	-.2894	-.3687	-.4569	-.5908	-.9759					
A4	NA	.1242	.1359	.1776	.2243	.2667	.3127	.3837	.5839					
A5	NA	-.0441	-.0670	-.0929	-.1129	-.1218	-.1257	-.1367	-.1796					
B1	NA	-.0320	-.0320	-.0320	-.0320	-.0320	-.0320	-.0320	-.0320					
B2	NA	-.9322	-.9322	-.9322	-.9322	-.9322	-.9322	-.9322	-.9322					
B3	NA	.5253	.5253	.5253	.5253	.5253	.5253	.5253	.5253					
B4	NA	1.0234	1.0235	1.0234	1.0234	1.0234	1.0234	1.0234	1.0234					
B5	NA	-1.2507	-1.2507	-1.2507	-1.2507	-1.2506	-1.2507	-1.2506	-1.2506					
TOTAL ANNUAL TRANSMITTED RADIATION														
DUE SOUTH AND VERTICAL QTA1 = 283099 QTA2 = 235429 QTA3 = 202310														
AZIMUTH AND TILT COEF. C1 = .0103 C2 = -.1238 C3 = -.5285 C4 = 1.9163 C5 = -1.1730														
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
TAVE:	53	52	60	69	74	80	81	81	79	69	59	55		
QHOR:	863	1182	1458	1979	2134	1916	1875	1784	1556	1443	1047	832		

DAYTONA BEACH, FLORIDA

										ELEVATION = 39		LAT = 29.2		
										TB55	TB60	TB65	TB70	TB80
										(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)
TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80						
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)						
VT1/DD	NA	1490.07	620.98	323.74	194.83	124.31	83.85	59.83	36.13					
VT2/DD	NA	1267.19	528.09	275.31	165.69	105.72	71.31	50.88	30.73					
VT3/DD	NA	1100.12	458.47	239.02	143.85	91.78	61.91	44.17	26.68					
MONTHLY DD	0	18	44	85	141	221	328	460	761					
ANNUAL DD	0	26	65	151	298	570	1009	1652	4003					
PARAMETER A	NA	.302	.461	.623	.726	.772	.744	.689	.671					
AZIMUTH AND TILT COEF.														
A1	NA	.0254	.0154	.0161	.0193	.0271	.0386	.0520	.0684					
A2	NA	.4324	.2414	.2090	.2146	.2546	.3439	.4634	.8007					
A3	NA	-.5186	-.2919	-.2558	-.2671	-.3248	-.4477	-.6121	-1.0874					
A4	NA	.2360	.1321	.1143	.1211	.1519	.2139	.2968	.5275					
A5	NA	.0376	.0201	.0170	.0131	.0063	-.0018	-.0119	-.0358					
B1	NA	-.0360	-.0360	-.0360	-.0360	-.0360	-.0360	-.0360	-.0360					
B2	NA	-.9655	-.9655	-.9655	-.9655	-.9655	-.9655	-.9655	-.9655					
B3	NA	.5374	.5374	.5374	.5374	.5374	.5374	.5374	.5374					
B4	NA	1.0469	1.0469	1.0469	1.0469	1.0469	1.0469	1.0469	1.0469					
B5	NA	-1.2670	-1.2670	-1.2670	-1.2670	-1.2671	-1.2670	-1.2670	-1.2670					
TOTAL ANNUAL TRANSMITTED RADIATION														
DUE SOUTH AND VERTICAL QTA1 = 278952 QTA2 = 232386 QTA3 = 199929														
AZIMUTH AND TILT COEF. C1 = .0313 C2 = -.1754 C3 = -.4271 C4 = 1.7868 C5 = -1.0886														
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
TAVE:	55	58	64	69	74	77	79	79	78	71	64	62		
QHOR:	939	1198	1605	1891	1931	1790	1755	1674	1465	1284	1039	873		

JACKSONVILLE, FLORIDA

										ELEVATION = 30		LAT = 30.5		
										TB55	TB60	TB65	TB70	TB80
										(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)
TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80						
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)						
VT1/DD	NA	642.69	325.39	197.17	127.07	85.11	60.47	45.55	29.72					
VT2/DD	NA	546.75	276.81	167.74	108.10	72.41	51.45	38.75	25.29					
VT3/DD	NA	474.64	240.30	145.61	93.84	62.86	44.66	33.64	21.95					
MONTHLY DD	3	40	80	131	204	304	428	568	871					
ANNUAL DD	3	85	187	354	615	1004	1561	2321	4693					
PARAMETER A	NA	.696	.633	.581	.572	.566	.559	.556	.617					
AZIMUTH AND TILT COEF.														
A1	NA	.0220	.0244	.0283	.0310	.0325	.0350	.0388	.0439					
A2	NA	.0050	.0560	.1153	.1761	.2457	.3166	.4075	.6487					
A3	NA	-.0069	-.0687	-.1413	-.2161	-.3042	-.3952	-.5183	-.8680					
A4	NA	.0191	.0498	.0899	.1326	.1817	.2333	.3015	.4779					
A5	NA	-.0117	-.0108	-.0125	-.0151	-.0190	-.0244	-.0359	-.0694					
B1	NA	-.0449	-.0449	-.0449	-.0449	-.0449	-.0449	-.0449	-.0449					
B2	NA	-.9591	-.9591	-.9591	-.9591	-.9591	-.9591	-.9591	-.9591					
B3	NA	.5433	.5433	.5433	.5433	.5433	.5433	.5433	.5433					
B4	NA	.9989	.9989	.9989	.9989	.9989	.9989	.9989	.9989					
B5	NA	-1.2352	-1.2352	-1.2352	-1.2353	-1.2352	-1.2352	-1.2352	-1.2352					
TOTAL ANNUAL TRANSMITTED RADIATION														
DUE SOUTH AND VERTICAL QTA1 = 274221 QTA2 = 228286 QTA3 = 196299														
AZIMUTH AND TILT COEF. C1 = .0087 C2 = -.1608 C3 = -.4468 C4 = 1.7977 C5 = -1.0939														
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
TAVE:	51	54	62	70	75	78	79	80	77	68	60	54		
QHOR:	875	1146	1550	1896	1980	1882	1805	1726	1402	1223	949	803		

MIAMI, FLORIDA										ELEVATION = 7	LAT = 25.8	
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	
VT1/DD	NA	NA	NA	NA	1061.19	506.28	283.78	180.63	74.62			
VT2/DD	NA	NA	NA	NA	901.70	430.18	241.13	153.49	63.40			
VT3/DD	NA	NA	NA	NA	782.79	373.46	209.33	133.25	55.04			
MONTHLY DD	0	1	3	11	29	60	107	168	407			
ANNUAL DD	0	1	5	21	59	133	264	507	2067			
PARAMETER A	NA	NA	NA	NA	.365	.361	.454	.535	.526			
AZIMUTH AND TILT COEF.												
A1	NA	NA	NA	NA	.0769	.0762	.0591	.0552	.0794			
A2	NA	NA	NA	NA	.3697	.4049	.3587	.4267	1.1039			
A3	NA	NA	NA	NA	-.4200	-.4630	-.4192	-.5374	-1.4634			
A4	NA	NA	NA	NA	.3209	.3566	.3202	.3748	.8415			
A5	NA	NA	NA	NA	.0169	.0143	.0031	-.0285	-.0623			
B1	NA	NA	NA	NA	.0022	.0022	.0022	.0022	.0022			
B2	NA	NA	NA	NA	-.9100	-.9100	-.9100	-.9100	-.9100			
B3	NA	NA	NA	NA	.4721	.4721	.4721	.4721	.4721			
B4	NA	NA	NA	NA	1.0518	1.0518	1.0518	1.0518	1.0518			
B5	NA	NA	NA	NA	-1.2849	-1.2850	-1.2850	-1.2849	-1.2850			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 276305			QTA2 = 230029			QTA3 = 197908					
AZIMUTH AND TILT COEF.	C1 = .0626			C2 = -.1094			C3 = -.4800			C4 = 1.8167 C5 = -1.0490		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	67	69	72	74	77	80	80	82	81	77	73	66
QHOR:	1044	1341	1592	1902	1794	1674	1748	1692	1496	1285	1184	1030

ORLANDO, FLORIDA										ELEVATION = 118	LAT = 28.5	
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	
VT1/DD	NA	NA	1806.72	671.66	331.06	184.24	114.47	77.53	43.76			
VT2/DD	NA	NA	1535.75	570.93	281.41	156.61	97.30	65.91	37.19			
VT3/DD	NA	NA	1333.20	495.63	244.29	135.96	84.47	57.21	32.29			
MONTHLY DD	0	3	16	43	88	158	255	376	666			
ANNUAL DD	0	5	27	80	193	413	796	1389	3507			
PARAMETER A	NA	NA	.326	.532	.564	.601	.586	.578	.592			
AZIMUTH AND TILT COEF.												
A1	NA	NA	-.0422	-.0235	-.0212	-.0171	-.0127	-.0075	.0061			
A2	NA	NA	-.1503	-.0388	.0395	.1238	.2616	.4394	.8579			
A3	NA	NA	.1215	.0094	-.0882	-.1931	-.3739	-.6134	-1.1863			
A4	NA	NA	-.0797	-.0108	.0436	.1015	.1986	.3221	.5972			
A5	NA	NA	-.0371	-.0251	-.0285	-.0315	-.0419	-.0558	-.0700			
B1	NA	NA	-.0095	-.0095	-.0095	-.0095	-.0095	-.0095	-.0095			
B2	NA	NA	-.9462	-.9462	-.9462	-.9462	-.9462	-.9462	-.9462			
B3	NA	NA	.5087	.5087	.5087	.5087	.5087	.5087	.5087			
B4	NA	NA	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621			
B5	NA	NA	-1.2665	-1.2665	-1.2665	-1.2665	-1.2665	-1.2665	-1.2665			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 283403			QTA2 = 236198			QTA3 = 203267					
AZIMUTH AND TILT COEF.	C1 = .0304			C2 = -.1557			C3 = -.4514			C4 = 1.7975 C5 = -1.0778		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	58	63	67	70	76	79	80	80	78	74	68	59
QHOR:	1008	1260	1575	1913	2013	1812	1793	1670	1478	1313	1125	910

TALLAHASSEE, FLORIDA										ELEVATION = 69	LAT = 30.4	
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=12)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	
VT1/DD	NA	466.66	268.80	168.71	109.67	75.66	55.17	42.08	27.73			
VT2/DD	NA	396.65	228.99	143.40	93.22	64.31	46.90	35.77	23.57			
VT3/DD	NA	344.27	198.82	124.46	80.91	55.82	40.70	31.05	20.46			
MONTHLY DD	14	53	92	148	227	329	452	592	899			
ANNUAL DD	23	143	295	523	855	1323	1958	2793	5287			
PARAMETER A	NA	.489	.505	.491	.495	.502	.501	.509	.575			
AZIMUTH AND TILT COEF.												
A1	NA	-.0051	.0238	.0031	.0055	.0069	.0085	.0112	.0175			
A2	NA	-.0311	.4239	.2265	.2833	.3266	.3919	.4908	.7255			
A3	NA	-.0086	-.4813	-.3248	-.3938	-.4498	-.5400	-.6798	-1.0078			
A4	NA	.0147	.3008	.2020	.2436	.2745	.3220	.3941	.5547			
A5	NA	-.0360	-.0086	-.0480	-.0507	-.0539	-.0617	-.0745	-.0911			
B1	NA	-.0156	-.0232	-.0156	-.0156	-.0156	-.0156	-.0156	-.0156			
B2	NA	-.9258	-1.0062	-.9258	-.9258	-.9258	-.9258	-.9258	-.9258			
B3	NA	.5201	.5112	.5201	.5201	.5201	.5201	.5201	.5201			
B4	NA	1.0203	.9328	1.0203	1.0202	1.0202	1.0202	1.0202	1.0202			
B5	NA	-1.2241	-1.2195	-1.2241	-1.2240	-1.2240	-1.2240	-1.2240	-1.2240			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 273514			QTA2 = 227749			QTA3 = 195879					
AZIMUTH AND TILT COEF.	C1 = .0137			C2 = -.1726			C3 = -.4304			C4 = 1.7838 C5 = -1.0852		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	51	51	60	67	72	77	79	78	77	69	57	51
QHOR:	870	1177	1459	1822	1901	1890	1761	1731	1488	1251	993	799

TAMPA, FLORIDA

				ELEVATION = 10				LAT = 28.0				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 2)	(M= 2)	(M= 2)	(M= 2)			
VT1/DD	NA	NA	1695.93	745.93	398.56	222.07	123.74	78.63	41.98			
VT2/DD	NA	NA	1442.03	634.26	338.89	186.61	103.98	66.07	35.28			
VT3/DD	NA	NA	1252.05	550.70	294.24	161.42	89.94	57.15	30.52			
MONTHLY DD	0	6	18	41	77	107	192	302	565			
ANNUAL DD	0	9	36	101	232	474	874	1477	3612			
PARAMETER A	NA	NA	.380	.374	.369	.409	.522	.560	.615			
AZIMUTH AND TILT COEF.												
A1	NA	NA	.0093	.0071	.0068	-.1084	-.0855	-.0805	-.0635			
A2	NA	NA	.2798	.3060	.4095	-.9739	-.6250	-.4347	-.0315			
A3	NA	NA	-.3233	-.3553	-.4921	1.0076	.6090	.3754	-.1320			
A4	NA	NA	.1218	.1309	.2010	-.4284	-.2435	-.1293	.1042			
A5	NA	NA	.0624	.0707	.0650	-.2264	-.1820	-.1723	-.1439			
B1	NA	NA	.0069	.0069	.0069	.0455	.0456	.0456	.0456			
B2	NA	NA	-.9751	-.9751	-.9751	-.6072	-.6072	-.6072	-.6072			
B3	NA	NA	.5195	.5195	.5194	.0769	.0769	.0769	.0769			
B4	NA	NA	1.0868	1.0868	1.0868	1.4135	1.4135	1.4135	1.4135			
B5	NA	NA	-1.3087	-1.3087	-1.3087	-1.2636	-1.2637	-1.2637	-1.2637			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 284283	QTA2 = 236840			QTA3 = 203785					
AZIMUTH AND TILT COEF.			C1 = .0492	C2 = -.1420	C3 = -.4766	C4 = 1.8242	C5 = -1.0800					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	59	59	66	69	76	79	80	81	79	72	66	60
QHQR:	1042	1190	1658	1898	2006	1859	1813	1664	1522	1343	1135	956

WEST PALM BEACH, FLORIDA

				ELEVATION = 20				LAT = 26.7				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	NA	NA	NA	1183.58	521.58	271.07	150.92	60.51			
VT2/DD	NA	NA	NA	NA	1004.30	442.57	230.01	128.06	51.35			
VT3/DD	NA	NA	NA	NA	871.62	384.11	199.63	111.14	44.56			
MONTHLY DD	0	0	1	7	23	52	99	178	445			
ANNUAL DD	0	0	1	12	44	123	281	600	2293			
PARAMETER A	NA	NA	NA	NA	.317	.681	.705	.645	.609			
AZIMUTH AND TILT COEF.												
A1	NA	NA	NA	NA	.0696	.0304	.0268	.0249	.0159			
A2	NA	NA	NA	NA	.4888	.2190	.2672	.3972	.7796			
A3	NA	NA	NA	NA	-.5920	-.2749	-.3485	-.5200	-1.0409			
A4	NA	NA	NA	NA	.3119	.1525	.1957	.2902	.5517			
A5	NA	NA	NA	NA	.0189	-.0043	-.0182	-.0272	-.0401			
B1	NA	NA	NA	NA	.0246	.0246	.0246	.0246	.0246			
B2	NA	NA	NA	NA	-.8754	-.8754	-.8754	-.8754	-.8754			
B3	NA	NA	NA	NA	.4202	.4201	.4202	.4202	.4201			
B4	NA	NA	NA	NA	1.1149	1.1149	1.1149	1.1149	1.1149			
B5	NA	NA	NA	NA	-1.2570	-1.2571	-1.2570	-1.2570	-1.2570			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 263327	QTA2 = 219275			QTA3 = 188669					
AZIMUTH AND TILT COEF.			C1 = .0552	C2 = -.0987	C3 = -.4875	C4 = 1.8292	C5 = -1.0233					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	65	67	70	74	78	80	81	82	80	76	72	68
QHQR:	982	1207	1553	1844	1844	1732	1734	1651	1394	1269	1067	962

ATLANTA, GEORGIA

				ELEVATION = 1033				LAT = 33.7				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	1037.30	187.47	108.15	69.67	48.80	36.80	29.31	24.33	18.17			
VT2/DD	883.06	159.60	92.07	59.31	41.55	31.32	24.95	20.72	15.46			
VT3/DD	766.54	138.54	79.92	51.48	36.06	27.19	21.66	17.98	13.42			
MONTHLY DD	21	119	205	319	455	604	758	913	1223			
ANNUAL DD	50	332	639	1079	1657	2392	3310	4417	7333			
PARAMETER A	.753	.664	.619	.588	.593	.615	.640	.662	.707			
AZIMUTH AND TILT COEF.												
A1	-.0277	-.0427	-.0526	-.0620	-.0658	-.0663	-.0654	-.0639	-.0588			
A2	-.0196	.0507	.1143	.1934	.2395	.2720	.3166	.3783	.5625			
A3	-.0011	-.0817	-.1598	-.2549	-.3099	-.3510	-.4136	-.5029	-.7756			
A4	.0313	.0942	.1501	.2155	.2521	.2783	.3166	.3694	.5203			
A5	-.0358	-.0393	-.0460	-.0510	-.0530	-.0567	-.0665	-.0813	-.1128			
B1	.0279	.0279	.0279	.0279	.0279	.0279	.0279	.0279	.0279			
B2	-.9408	-.9408	-.9408	-.9408	-.9408	-.9408	-.9408	-.9408	-.9408			
B3	.5415	.5415	.5415	.5415	.5415	.5415	.5415	.5415	.5415			
B4	.8948	.8948	.8948	.8948	.8948	.8948	.8948	.8948	.8948			
B5	-1.2264	-1.2264	-1.2264	-1.2264	-1.2263	-1.2264	-1.2264	-1.2264	-1.2264			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 270595	QTA2 = 225194			QTA3 = 193508					
AZIMUTH AND TILT COEF.			C1 = -.0107	C2 = -.1937	C3 = -.4441	C4 = 1.7889	C5 = -1.1150					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	40	43	50	63	68	73	76	76	72	61	51	43
QHQR:	695	931	1328	1661	1979	1890	1884	1783	1347	1254	887	690

AUGUSTA, GEORGIA												
ELEVATION = 148												
LAT = 33.4												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	1219.46	256.96	153.70	96.80	65.61	47.73	36.59	29.23	20.73			
VT2/DD	1031.33	219.01	129.99	82.36	55.83	40.61	31.13	24.87	17.64			
VT3/DD	893.78	189.90	112.65	71.48	48.45	35.24	27.02	21.58	15.31			
MONTHLY DD	20	92	156	228	337	463	604	756	1066			
ANNUAL DD	55	314	576	952	1458	2115	2938	3957	6730			
PARAMETER A	.549	.537	.494	.519	.562	.597	.620	.645	.689			
AZIMUTH AND TILT COEF.												
A1	.0451	.0551	.0642	.0048	.0060	.0065	.0067	.0065	.0063			
A2	-.3724	-.3792	-.4009	.1998	.2157	.2419	.2816	.3343	.5177			
A3	.3742	.3769	.3959	-.3552	-.3680	-.3977	-.4487	-.5181	-.7723			
A4	-.2790	-.2738	-.2852	.3061	.3084	.3227	.3505	.3872	.5203			
A5	-.0332	-.0403	-.0455	-.1537	-.1455	-.1423	-.1440	-.1469	-.1657			
B1	-.0274	-.0274	-.0274	-.0049	-.0049	-.0049	-.0049	-.0049	-.0049			
B2	-.7643	-.7643	-.7643	-.9219	-.9219	-.9219	-.9218	-.9219	-.9218			
B3	.2692	.2692	.2692	.5415	.5415	.5415	.5414	.5415	.5415			
B4	1.1842	1.1842	1.1842	.9094	.9094	.9094	.9094	.9094	.9094			
B5	-1.2892	-1.2892	-1.2892	-1.2045	-1.2045	-1.2045	-1.2045	-1.2045	-1.2045			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 273830	QTA2 = 228165			QTA3 = 196198					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	45	45	52	64	71	76	78	78	72	61	53	47
QHOR:	718	1001	1342	1665	1916	1894	1814	1666	1376	1223	924	704

MACON, GEORGIA												
ELEVATION = 361												
LAT = 32.7												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	1530.47	268.68	146.34	90.98	62.38	45.52	35.02	28.17	20.23			
VT2/DD	1302.74	228.70	124.56	77.44	53.10	38.75	29.81	23.90	17.22			
VT3/DD	1130.89	198.53	108.13	67.23	46.09	33.64	25.88	20.82	14.95			
MONTHLY DD	15	83	152	245	357	489	636	790	1100			
ANNUAL DD	26	208	430	775	1244	1859	2643	3624	6303			
PARAMETER A	.601	.717	.744	.732	.734	.756	.769	.771	.787			
AZIMUTH AND TILT COEF.												
A1	-.0213	-.0254	-.0269	-.0297	-.0312	-.0310	-.0310	-.0311	-.0291			
A2	.0816	.0617	.0646	.0930	.1384	.1815	.2347	.3032	.4817			
A3	-.1120	-.0990	-.1081	-.1491	-.2102	-.2671	-.3373	-.4298	-.6819			
A4	.0833	.0820	.0894	.1151	.1501	.1821	.2229	.2766	.4163			
A5	-.0193	-.0319	-.0380	-.0445	-.0496	-.0534	-.0587	-.0672	-.0949			
B1	.0095	.0095	.0095	.0095	.0095	.0095	.0095	.0095	.0095			
B2	-.9561	-.9561	-.9561	-.9561	-.9561	-.9561	-.9561	-.9561	-.9561			
B3	.5511	.5511	.5511	.5511	.5511	.5511	.5511	.5512	.5512			
B4	.9340	.9340	.9340	.9339	.9339	.9339	.9340	.9339	.9339			
B5	-1.2484	-1.2484	-1.2484	-1.2484	-1.2484	-1.2484	-1.2485	-1.2484	-1.2484			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 275785	QTA2 = 229589			QTA3 = 197331					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	44	48	56	64	72	78	79	78	73	63	53	48
QHOR:	705	1009	1369	1806	1900	1966	1788	1731	1435	1231	936	760

SAVANNAH, GEORGIA												
ELEVATION = 52												
LAT = 32.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 12)	(M= 12)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	484.15	240.02	144.15	93.22	64.31	47.45	36.64	24.73			
VT2/DD	NA	412.35	204.43	122.77	79.40	54.77	40.41	31.20	21.06			
VT3/DD	NA	358.03	177.50	106.60	68.94	47.56	35.09	27.09	18.29			
MONTHLY DD	5	49	98	163	253	366	497	643	953			
ANNUAL DD	12	155	328	599	995	1530	2227	3129	5743			
PARAMETER A	NA	.624	.597	.556	.536	.546	.559	.582	.648			
AZIMUTH AND TILT COEF.												
A1	NA	-.0599	-.0685	-.0761	-.0784	-.0753	-.0718	-.0665	-.0526			
A2	NA	.1110	.2023	.2607	.3086	.3416	.3928	.4679	.6842			
A3	NA	-.2071	-.3156	-.3864	-.4460	-.4879	-.5560	-.6574	-.9511			
A4	NA	.1232	.1833	.2258	.2603	.2828	.3178	.3689	.5178			
A5	NA	-.0647	-.0613	-.0622	-.0638	-.0650	-.0683	-.0735	-.0905			
B1	NA	.0382	.0382	.0382	.0382	.0382	.0382	.0382	.0382			
B2	NA	-1.0090	-1.0090	-1.0090	-1.0090	-1.0090	-1.0090	-1.0090	-1.0090			
B3	NA	.5940	.5941	.5940	.5940	.5941	.5940	.5940	.5940			
B4	NA	.9683	.9683	.9682	.9683	.9682	.9682	.9683	.9682			
B5	NA	-1.2565	-1.2565	-1.2564	-1.2564	-1.2564	-1.2564	-1.2565	-1.2564			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 271750	QTA2 = 226572			QTA3 = 194916					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	49	49	57	65	71	77	78	79	75	67	56	49
QHOR:	758	1069	1421	1789	1815	1873	1683	1610	1322	1219	917	796

BOISE, IDAHO				ELEVATION = 2867				LAT = 43.6				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT.	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	266.16	70.98	46.61	34.19	26.96	22.25	18.95	16.50	13.10			
VT2/DD	227.91	60.78	39.95	29.31	23.11	19.08	16.24	14.14	11.23			
VT3/DD	198.02	52.81	34.72	25.47	20.08	16.58	14.11	12.29	9.76			
MONTHLY DD	78	293	424	578	733	888	1043	1198	1508			
ANNUAL DD	180	973	1651	2494	3503	4667	5981	7429	10631			
PARAMETER A	.670	.720	.755	.784	.810	.832	.855	.872	.881			
AZIMUTH AND TILT COEF.												
A1	.0879	.0951	-.0668	-.0623	-.0585	-.0556	-.0533	-.0517	-.0506			
A2	.0296	.1238	.2845	.3366	.3934	.4466	.4960	.5473	.6706			
A3	-.0761	-.1722	-.2654	-.3305	-.4036	-.4766	-.5489	-.6266	-.8103			
A4	.0265	.1015	.2212	.2604	.3028	.3436	.3830	.4257	.5297			
A5	-.0275	-.0294	.0130	.0075	.0003	-.0097	-.0225	-.0385	-.0759			
B1	-.0377	-.0377	.0389	.0389	.0389	.0389	.0389	.0389	.0389			
B2	-1.1587	-1.1587	-1.1990	-1.1991	-1.1991	-1.1991	-1.1991	-1.1990	-1.1991			
B3	.7989	.7988	.8424	.8424	.8425	.8424	.8425	.8424	.8424			
B4	.6012	.6012	.5368	.5368	.5368	.5368	.5368	.5368	.5368			
B5	-1.1894	-1.1894	-1.1849	-1.1849	-1.1848	-1.1848	-1.1849	-1.1849	-1.1849			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 336744	QTA2 = 280651		QTA3 = 241023					
AZIMUTH AND TILT COEF.				C1 = .0108	C2 = -.2363	C3 = -.4488	C4 = 1.6951	C5 = -1.3457				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	30	37	40	47	58	66	74	72	64	51	40	31
QHOR:	496	880	1261	1856	2244	2506	2636	2229	1715	1139	606	436

LEWISTON, IDAHO				ELEVATION = 1437				LAT = 46.4				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT.	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	108.71	45.15	31.18	22.16	16.85	13.59	11.39	9.80	7.66			
VT2/DD	92.80	38.54	26.62	18.97	14.42	11.63	9.75	8.39	6.56			
VT3/DD	80.57	33.46	23.11	16.48	12.53	10.10	8.47	7.29	5.70			
MONTHLY DD	117	281	407	492	647	802	957	1112	1422			
ANNUAL DD	212	774	1368	2175	3169	4353	5701	7186	10452			
PARAMETER A	.364	.745	.772	.812	.871	.930	.981	1.022	1.072			
AZIMUTH AND TILT COEF.												
A1	-.1240	-.0686	-.0774	.0430	.0358	.0304	.0266	.0239	.0203			
A2	-.2581	-.0094	.0569	.3668	.3744	.3783	.3842	.3949	.4328			
A3	.1930	-.0182	-.0807	-.3433	-.3597	-.3745	-.3927	-.4174	-.4859			
A4	-.0775	.0338	.0747	.1925	.2064	.2189	.2326	.2495	.2938			
A5	-.1108	-.0385	.0286	.0744	.0650	.0535	.0411	.0282	.0023			
B1	-.0847	.0847	.0847	.0139	.0139	.0139	.0139	.0139	.0139			
B2	-1.0085	-1.0085	-1.0085	-1.1317	-1.1317	-1.1317	-1.1317	-1.1317	-1.1317			
B3	.6987	.6986	.6986	.8282	.8282	.8282	.8282	.8282	.8282			
B4	.6211	.6211	.6211	.5370	.5370	.5370	.5370	.5370	.5370			
B5	-1.0751	-1.0752	-1.0752	-1.0948	-1.0948	-1.0948	-1.0948	-1.0948	-1.0948			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 263355	QTA2 = 219543		QTA3 = 188727					
AZIMUTH AND TILT COEF.				C1 = .0142	C2 = -.2602	C3 = -.3425	C4 = 1.6196	C5 = -1.2342				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	32	39	41	49	59	66	75	71	61	50	40	34
QHOR:	361	619	1026	1391	1844	1999	2343	1886	1413	835	394	275

POCATELLO, IDAHO				ELEVATION = 4478				LAT = 42.9				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT.	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	88.98	45.62	34.04	27.06	22.44	19.17	16.73	14.85	12.11			
VT2/DD	76.19	39.08	29.17	23.18	19.23	16.43	14.34	12.72	10.38			
VT3/DD	66.20	33.96	25.34	20.14	16.71	14.27	12.46	11.05	9.02			
MONTHLY DD	278	447	599	754	909	1064	1219	1374	1684			
ANNUAL DD	636	1740	2587	3583	4711	5969	7352	8847	12104			
PARAMETER A	.563	.728	.807	.850	.877	.896	.911	.921	.918			
AZIMUTH AND TILT COEF.												
A1	-.0312	-.0457	-.0457	-.0450	-.0439	-.0432	-.0405	-.0389	-.0367			
A2	.0535	.2396	.2905	.3464	.4004	.4520	.5014	.5536	.6757			
A3	-.0550	-.2609	-.3293	-.4020	-.4730	-.5428	-.6119	-.6868	-.8627			
A4	-.0097	.2009	.2356	.2751	.3146	.3533	.3919	.4342	.5357			
A5	.0201	-.0238	-.0302	-.0367	-.0442	-.0530	-.0638	-.0772	-.1102			
B1	.0135	.0113	.0113	.0113	.0113	.0113	.0113	.0113	.0113			
B2	-1.1576	-1.1760	-1.1760	-1.1760	-1.1760	-1.1760	-1.1760	-1.1760	-1.1760			
B3	.7658	.8167	.8168	.8168	.8168	.8168	.8168	.8167	.8168			
B4	.6288	.5532	.5532	.5532	.5532	.5532	.5532	.5532	.5532			
B5	-1.2291	-1.1885	-1.1885	-1.1884	-1.1885	-1.1885	-1.1885	-1.1885	-1.1884			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 348164	QTA2 = 290185		QTA3 = 249205					
AZIMUTH AND TILT COEF.				C1 = .0048	C2 = -.2279	C3 = -.4555	C4 = 1.6850	C5 = -1.3620				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	22	29	38	42	55	63	72	70	59	47	36	25
QHOR:	575	936	1382	1815	2249	2423	2672	2213	1758	1196	691	458

CHICAGO, ILLINOIS

ELEVATION = 623

LAT = 41.8

	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT. (M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	91.16	39.95	29.06	22.65	18.51	15.62	13.48	11.86	9.56			
VT2/DD	77.92	34.18	24.86	19.38	15.84	13.37	11.54	10.15	8.18			
VT3/DD	67.68	29.69	21.60	16.83	13.76	11.61	10.02	8.82	7.10			
MONTHLY DD	213	382	525	674	825	977	1132	1287	1597			
ANNUAL DD	624	1581	2284	3100	4026	5076	6272	7622	10768			
PARAMETER A	.432	.546	.618	.677	.724	.768	.809	.848	.909			
AZIMUTH AND TILT COEF.												
A1	-.1014	.0649	.0583	.0536	.0501	.0474	.0454	.0440	.0424			
A2	.3012	.5024	.4799	.4707	.4771	.4874	.4995	.5128	.5549			
A3	-.2926	-.5212	-.5044	-.5038	-.5228	-.5462	-.5711	-.5967	-.6700			
A4	.1937	.3547	.3376	.3315	.3382	.3488	.3616	.3761	.4200			
A5	.0330	-.0056	-.0054	-.0080	-.0130	-.0189	-.0251	-.0318	-.0513			
B1	.0383	-.0078	-.0078	-.0078	-.0078	-.0078	-.0078	-.0078	-.0078			
B2	-1.0799	-1.1246	-1.1246	-1.1246	-1.1246	-1.1246	-1.1246	-1.1246	-1.1246			
B3	.7087	.7798	.7798	.7798	.7798	.7798	.7798	.7798	.7798			
B4	.6758	.6070	.6070	.6070	.6070	.6070	.6070	.6070	.6070			
B5	-1.1935	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 267580			QTA2 = 223141			QTA3 = 191797					
AZIMUTH AND TILT COEF.	C1 = .0413			C2 = -.3014			C3 = -.3070					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	25	26	34	48	60	71	75	73	66	55	42	28
QHOR:	503	802	1118	1411	1771	1955	1992	1792	1322	927	575	383

MOLINE, ILLINOIS

ELEVATION = 591

LAT = 41.4

	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	60.64	34.72	27.65	22.83	19.38	16.83	14.87	13.32	11.02			
VT2/DD	51.85	29.68	23.65	19.52	16.57	14.39	12.71	11.39	9.42			
VT3/DD	45.04	25.78	20.54	16.96	14.39	12.50	11.04	9.89	8.18			
MONTHLY DD	326	570	716	867	1022	1177	1332	1487	1797			
ANNUAL DD	739	1722	2411	3208	4126	5182	6381	7735	10897			
PARAMETER A	.715	.733	.724	.729	.742	.760	.775	.792	.812			
AZIMUTH AND TILT COEF.												
A1	-.0193	-.0106	-.0055	-.0008	.0038	.0084	.0127	.0164	.0214			
A2	.0906	.1603	.2052	.2445	.2829	.3248	.3732	.4215	.5381			
A3	-.0898	-.1729	-.2226	-.2652	-.3112	-.3646	-.4284	-.4932	-.6546			
A4	.0911	.1403	.1709	.1963	.2226	.2527	.2889	.3261	.4208			
A5	-.0161	-.0172	-.0144	-.0122	-.0123	-.0150	-.0198	-.0259	-.0468			
B1	.0093	.0093	.0093	.0093	.0093	.0093	.0093	.0093	.0093			
B2	-1.0890	-1.0890	-1.0890	-1.0890	-1.0890	-1.0890	-1.0890	-1.0890	-1.0890			
B3	.7150	.7150	.7150	.7150	.7150	.7150	.7151	.7151	.7151			
B4	.6635	.6634	.6635	.6635	.6634	.6635	.6634	.6634	.6634			
B5	-1.1948	-1.1948	-1.1949	-1.1948	-1.1948	-1.1948	-1.1948	-1.1948	-1.1948			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 274671			QTA2 = 229286			QTA3 = 191712					
AZIMUTH AND TILT COEF.	C1 = .0431			C2 = -.3213			C3 = -.2755					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	22	25	36	51	61	71	73	72	64	53	40	29
QHOR:	505	811	1138	1473	1712	1984	1914	1679	1350	1003	612	481

SPRINGFIELD, ILLINOIS

ELEVATION = 614

LAT = 39.8

	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT. (M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	100.24	50.00	35.89	27.51	22.12	18.47	15.86	13.89	11.13			
VT2/DD	85.70	42.75	30.69	23.52	18.91	15.79	13.56	11.88	9.52			
VT3/DD	74.44	37.13	26.65	20.43	16.42	13.72	11.77	10.31	8.27			
MONTHLY DD	232	347	484	631	785	940	1095	1250	1560			
ANNUAL DD	504	1321	1917	2635	3487	4479	5605	6876	9904			
PARAMETER A	.507	.525	.616	.685	.739	.778	.805	.831	.878			
AZIMUTH AND TILT COEF.												
A1	-.0476	.0472	.0370	.0311	.0279	.0264	.0259	.0254	.0246			
A2	.2249	.2928	.2865	.2899	.3043	.3346	.3738	.4115	.4921			
A3	-.2182	-.3222	-.3161	-.3221	-.3438	-.3862	-.4404	-.4931	-.6122			
A4	.0736	.3150	.2936	.2872	.2937	.3154	.3460	.3760	.4432			
A5	.0773	-.0837	-.0683	-.0606	-.0588	-.0613	-.0666	-.0726	-.0918			
B1	.0073	-.0257	-.0257	-.0257	-.0257	-.0257	-.0257	-.0257	-.0257			
B2	-1.1005	-1.0831	-1.0831	-1.0831	-1.0831	-1.0831	-1.0831	-1.0831	-1.0831			
B3	.7126	.7222	.7222	.7222	.7222	.7222	.7222	.7222	.7222			
B4	.7132	.6481	.6481	.6480	.6481	.6481	.6481	.6481	.6481			
B5	-1.2330	-1.1647	-1.1647	-1.1647	-1.1647	-1.1648	-1.1648	-1.1647	-1.1647			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 275387			QTA2 = 229442			QTA3 = 191726					
AZIMUTH AND TILT COEF.	C1 = -.0070			C2 = -.2654			C3 = -.3687					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	27	30	42	53	64	73	75	75	67	55	41	29
QHOR:	596	869	1154	1525	1768	2085	2010	1861	1387	1059	622	452

EVANSVILLE, INDIANA

ELEVATION = 387

LAT = 38.1

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)
VT1/DD	203.65	69.92	46.19	33.84	26.43	21.55	18.11	15.56	12.14
VT2/DD	173.70	59.71	39.44	28.90	22.57	18.40	15.47	13.29	10.36
VT3/DD	150.80	51.85	34.25	25.09	19.60	15.98	13.43	11.54	9.00
MONTHLY DD	97	245	370	505	647	793	944	1099	1408
ANNUAL DD	249	910	1453	2111	2885	3784	4845	6073	9052
PARAMETER A	.403	.424	.505	.551	.582	.617	.662	.707	.777

AZIMUTH AND TILT COEF.

A1	-.1532	.1403	.1117	.0986	.0904	.0829	.0751	.0684	.0592
A2	-.2373	.4905	.4575	.4677	.4858	.4944	.4967	.5104	.5808
A3	-.2270	-.5349	-.5089	-.5278	-.5531	-.5677	-.5785	-.6068	-.7244
A4	.1842	.3404	.3254	.3383	.3566	.3682	.3759	.3928	.4619
A5	.0435	-.0074	-.0117	-.0147	-.0171	-.0201	-.0257	-.0347	-.0632
B1	.0619	-.0188	-.0188	-.0188	-.0188	-.0188	-.0188	-.0188	-.0188
B2	-.9932	-1.0476	-1.0476	-1.0476	-1.0476	-1.0476	-1.0476	-1.0476	-1.0476
B3	.6301	.7056	.7056	.7056	.7056	.7056	.7056	.7056	.7056
B4	.7635	.7089	.7089	.7089	.7089	.7089	.7089	.7089	.7089
B5	-1.1885	-1.1577	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578	-1.1577	-1.1578

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL	QTA1 = 258260	QTA2 = 215074	QTA3 = 184801
AZIMUTH AND TILT COEF.	C1 = .0157	C2 = -.2558	C3 = -.3510
MONTH: JAN	FEB	MAR	APR
TAVE: 32	33	44	56
QHOR: 571	793	1106	1494
MAY	JUN	JUL	AUG
66	74	77	76
1744	1925	1900	1724
SEP	OCT	NOV	DEC
67	58	44	34
1378	1051	668	481

FORT WAYNE, INDIANA

ELEVATION = 827

LAT = 41.0

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)
VT1/DD	53.50	28.15	22.22	18.30	15.55	12.99	11.06	9.61	7.62
VT2/DD	45.66	24.03	18.96	15.62	13.27	11.08	9.43	8.20	6.50
VT3/DD	39.64	20.86	16.46	13.56	11.52	9.62	8.19	7.12	5.64
MONTHLY DD	299	569	721	876	1031	877	1031	1186	1496
ANNUAL DD	645	1649	2341	3141	4061	5121	6340	7731	10983
PARAMETER A	.807	.678	.643	.637	.648	.719	.789	.853	.947

AZIMUTH AND TILT COEF.

A1	-.0006	-.0013	-.0039	-.0054	-.0059	-.0905	-.0798	-.0712	-.0601
A2	.1903	.3542	.4222	.4607	.4836	.3651	.3654	.3557	.3855
A3	-.1940	-.3614	-.4328	-.4765	-.5076	-.4459	-.4407	-.4462	-.4998
A4	.0987	.1851	.2254	.2518	.2723	.3279	.3188	.3171	.3423
A5	.0375	.0712	.0813	.0831	.0784	-.0679	-.0669	-.0683	-.0796
B1	.0159	.0159	.0159	.0159	.0159	.0587	.0587	.0587	.0587
B2	-1.0225	-1.0225	-1.0224	-1.0225	-1.0225	-.9801	-.9800	-.9801	-.9800
B3	.6940	.6940	.6940	.6940	.6940	.6804	.6804	.6804	.6804
B4	.7182	.7183	.7183	.7183	.7183	.6881	.6881	.6881	.6881
B5	-1.1325	-1.1325	-1.1325	-1.1325	-1.1325	-1.0649	-1.0649	-1.0649	-1.0649

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL	QTA1 = 231389	QTA2 = 192744	QTA3 = 165682
AZIMUTH AND TILT COEF.	C1 = .0289	C2 = -.2343	C3 = -.3114
MONTH: JAN	FEB	MAR	APR
TAVE: 21	28	34	50
QHOR: 469	693	960	1382
MAY	JUN	JUL	AUG
60	70	72	70
1668	1849	1748	1608
SEP	OCT	NOV	DEC
63	53	41	31
1206	899	527	350

INDIANAPOLIS, INDIANA

ELEVATION = 807

LAT = 39.7

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)
VT1/DD	63.94	34.47	26.94	20.79	16.64	13.85	11.87	10.38	8.30
VT2/DD	54.58	29.42	22.99	17.74	14.20	11.82	10.13	8.86	7.08
VT3/DD	47.38	25.54	19.96	15.40	12.32	10.26	8.79	7.69	6.15
MONTHLY DD	260	483	618	618	772	927	1082	1237	1547
ANNUAL DD	538	1392	2032	2807	3703	4713	5867	7185	10338
PARAMETER A	.658	.595	.594	.665	.733	.785	.833	.879	.956

AZIMUTH AND TILT COEF.

A1	.0030	-.0109	-.0192	-.0594	-.0565	-.0548	-.0532	-.0514	-.0485
A2	.1649	.3402	.3958	.3601	.3538	.3576	.3672	.3792	.4219
A3	-.1761	-.3747	-.4396	-.4444	-.4398	-.4484	-.4654	-.4864	-.5568
A4	.0659	.1654	.2024	.2564	.2547	.2611	.2726	.2866	.3306
A5	.0399	.0569	.0581	-.0330	-.0341	-.0373	-.0421	-.0484	-.0669
B1	.0461	.0461	.0461	.0626	.0626	.0626	.0626	.0626	.0626
B2	-1.0318	-1.0318	-1.0318	-1.0190	-1.0190	-1.0190	-1.0190	-1.0190	-1.0190
B3	.7009	.7010	.7009	.7072	.7072	.7072	.7072	.7072	.7072
B4	.7289	.7288	.7288	.7038	.7039	.7039	.7039	.7038	.7038
B5	-1.1383	-1.1383	-1.1383	-1.0975	-1.0975	-1.0975	-1.0975	-1.0975	-1.0975

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL	QTA1 = 241904	QTA2 = 201465	QTA3 = 173135
AZIMUTH AND TILT COEF.	C1 = .0114	C2 = -.2439	C3 = -.3295
MONTH: JAN	FEB	MAR	APR
TAVE: 25	30	39	51
QHOR: 488	699	1065	1371
MAY	JUN	JUL	AUG
61	71	74	74
1740	1873	1751	1616
SEP	OCT	NOV	DEC
65	55	42	30
1317	1020	593	385

SOUTH BEND, INDIANA												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
ELEVATION = 774 LAT = 41.7												
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)			
VT1/DD	57.74	28.13	21.55	17.36	14.53	12.49	10.87	9.52	7.62			
VT2/DD	49.28	24.01	18.39	14.82	12.40	10.66	9.28	8.12	6.51			
VT3/DD	42.79	20.85	15.97	12.86	10.76	9.25	8.05	7.05	5.65			
MONTHLY DD	239	490	640	794	949	1104	1092	1247	1557			
ANNUAL DD	585	1564	2279	3125	4098	5206	6464	7884	11140			
PARAMETER A	.652	.658	.683	.711	.742	.775	.817	.872	.952			
AZIMUTH AND TILT COEF.												
A1	.0738	.0722	.0682	.0644	.0609	.0577	.0179	.0172	.0171			
A2	.1810	.2979	.3192	.3376	.3549	.3693	.3519	.3545	.3873			
A3	-.1739	-.3083	-.3363	-.3646	-.3927	-.4172	-.4369	-.4473	-.5069			
A4	.1009	.1790	.1984	.2182	.2374	.2541	.3271	.3296	.3615			
A5	.0241	.0252	.0209	.0135	.0057	-.0016	-.0771	-.0808	-.0979			
B1	-.0406	-.0406	-.0406	-.0406	-.0406	-.0406	-.0188	-.0188	-.0188			
B2	-1.0144	-1.0143	-1.0143	-1.0144	-1.0143	-1.0143	-1.0001	-1.0001	-1.0001			
B3	.6759	.6759	.6759	.6759	.6758	.6758	.6880	.6879	.6880			
B4	.6980	.6980	.6980	.6980	.6980	.6980	.6565	.6566	.6566			
B5	-1.1252	-1.1252	-1.1252	-1.1252	-1.1252	-1.1252	-1.0797	-1.0797	-1.0797			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 241738			QTA2 = 201190			QTA3 = 172799					
AZIMUTH AND TILT COEF.	C1 = .0146			C2 = -.2343			C3 = -.3603					
MONTH: JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC												
TAVE:	24	27	34	46	61	67	72	70	64	53	41	29
QHQR:	398	649	981	1353	1698	1951	1916	1783	1359	897	520	348

BURLINGTON, IOWA												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
ELEVATION = 702 LAT = 40.8												
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)			
VT1/DD	68.74	41.05	33.08	27.52	23.52	20.53	18.21	16.12	12.86			
VT2/DD	58.81	35.12	28.30	23.54	20.12	17.57	15.58	13.81	11.01			
VT3/DD	51.10	30.51	24.59	20.45	17.48	15.26	13.54	12.00	9.57			
MONTHLY DD	364	609	756	909	1063	1218	1373	1222	1532			
ANNUAL DD	661	1635	2326	3129	4035	5061	6232	7563	10707			
PARAMETER A	.663	.678	.649	.626	.617	.622	.629	.656	.722			
AZIMUTH AND TILT COEF.												
A1	.0216	.0301	.0335	.0362	.0379	.0390	.0404	-.0051	-.0015			
A2	.1497	.2271	.2958	.3650	.4254	.4812	.5462	.6946	.7728			
A3	-.1318	-.2268	-.3026	-.3798	-.4504	-.5217	-.6083	-.7541	-.8920			
A4	.1051	.1556	.2033	.2524	.2969	.3406	.3925	.5454	.6143			
A5	.0178	.0207	.0240	.0262	.0253	.0195	.0105	-.0230	-.0549			
B1	-.0372	-.0372	-.0372	-.0372	-.0372	-.0372	-.0372	-.0176	-.0176			
B2	-1.1354	-1.1354	-1.1354	-1.1354	-1.1354	-1.1354	-1.1354	-1.1674	-1.1674			
B3	.7479	.7479	.7479	.7479	.7479	.7479	.7479	.7952	.7952			
B4	.6780	.6780	.6780	.6780	.6780	.6780	.6780	.6106	.6107			
B5	-1.2367	-1.2367	-1.2367	-1.2367	-1.2367	-1.2367	-1.2367	-1.2070	-1.2070			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 295976			QTA2 = 246856			QTA3 = 212158					
AZIMUTH AND TILT COEF.	C1 = -.0169			C2 = -.3221			C3 = -.3190					
MONTH: JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC												
TAVE:	20	26	37	53	60	71	74	73	65	54	41	30
QHQR:	611	860	1213	1562	1909	2125	2162	1890	1450	1087	649	462

DES MOINES, IOWA												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
ELEVATION = 965 LAT = 41.5												
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)			
VT1/DD	58.00	35.29	28.94	24.46	21.18	18.67	16.70	15.10	12.46			
VT2/DD	49.65	30.20	24.77	20.94	18.13	15.98	14.29	12.93	10.67			
VT3/DD	43.14	26.24	21.52	18.19	15.75	13.89	12.42	11.23	9.27			
MONTHLY DD	422	694	846	1001	1155	1310	1465	1621	1586			
ANNUAL DD	877	1909	2619	3444	4384	5453	6678	8067	11275			
PARAMETER A	.637	.678	.666	.656	.654	.660	.674	.688	.717			
AZIMUTH AND TILT COEF.												
A1	-.0204	-.0287	-.0336	-.0372	-.0390	-.0392	-.0380	-.0365	.1155			
A2	.1850	.2586	.3103	.3604	.4097	.4605	.5152	.5778	.8209			
A3	-.1599	-.2435	-.2992	-.3556	-.4149	-.4803	-.5550	-.6428	-.9987			
A4	.1050	.1590	.1952	.2309	.2669	.3052	.3478	.3975	.5990			
A5	.0296	.0305	.0334	.0346	.0331	.0285	.0202	.0085	-.0622			
B1	.0285	.0285	.0285	.0285	.0285	.0285	.0285	.0285	-.0424			
B2	-1.1366	-1.1366	-1.1366	-1.1366	-1.1366	-1.1366	-1.1366	-1.1366	-1.1705			
B3	.7435	.7435	.7435	.7435	.7435	.7435	.7435	.7435	.8121			
B4	.6505	.6504	.6505	.6505	.6505	.6504	.6505	.6504	.5962			
B5	-1.2366	-1.2366	-1.2366	-1.2366	-1.2366	-1.2366	-1.2366	-1.2366	-1.2003			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 294691			QTA2 = 245879			QTA3 = 211347					
AZIMUTH AND TILT COEF.	C1 = .0241			C2 = -.2860			C3 = -.3427					
MONTH: JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC												
TAVE:	17	23	36	50	60	70	74	72	63	53	39	28
QHQR:	579	883	1204	1557	1866	2140	2094	1798	1442	1034	604	461

MASON CITY, IOWA				ELEVATION = 1224				LAT = 43.2				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	54.27	30.14	24.22	20.23	17.37	15.22	13.54	12.20	10.18			
VT2/DD	46.52	25.83	20.76	17.34	14.89	13.04	11.61	10.45	8.72			
VT3/DD	40.43	22.45	18.04	15.07	12.94	11.34	10.09	9.09	7.58			
MONTHLY DD	351	632	786	941	1096	1251	1406	1561	1871			
ANNUAL DD	1317	2652	3492	4428	5473	6635	7930	9372	12651			
PARAMETER A	.440	.603	.659	.696	.732	.764	.796	.826	.864			
AZIMUTH AND TILT COEF.												
A1	.2603	.1875	.1718	.1627	.1541	.1466	.1395	.1332	.1256			
A2	.5265	.4576	.4593	.4752	.4931	.5135	.5334	.5570	.6368			
A3	-.4792	-.4340	-.4439	-.4691	-.4982	-.5310	-.5637	-.6032	-.7277			
A4	.3918	.3439	.3456	.3579	.3718	.3877	.4035	.4233	.4919			
A5	.0106	.0071	.0060	.0038	.0001	-.0044	-.0095	-.0174	-.0425			
B1	-.0753	-.0753	-.0753	-.0753	-.0753	-.0753	-.0753	-.0753	-.0753			
B2	-1.1923	-1.1923	-1.1923	-1.1923	-1.1923	-1.1923	-1.1923	-1.1923	-1.1923			
B3	.8289	.8289	.8289	.8289	.8289	.8289	.8289	.8289	.8289			
B4	.5370	.5370	.5370	.5370	.5370	.5370	.5370	.5370	.5370			
B5	-1.1996	-1.1997	-1.1996	-1.1996	-1.1996	-1.1996	-1.1996	-1.1996	-1.1996			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 302928	QTA2 = 253120			QTA3 = 217709				
AZIMUTH AND TILT COEF.				C1 = .0085	C2 = -.3431	C3 = -.2704	C4 = 1.5556	C5 = -1.2773				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	17	16	29	45	57	69	72	69	61	49	35	19
QHOR:	553	851	1232	1448	1926	2143	2128	1797	1429	986	580	412

SIOUX CITY, IOWA				ELEVATION = 1102				LAT = 42.4				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	58.26	36.63	30.25	25.73	22.39	19.74	17.29	15.37	12.58			
VT2/DD	49.91	31.37	25.91	22.04	19.18	16.92	14.81	13.17	10.78			
VT3/DD	43.37	27.26	22.52	19.15	16.66	14.70	12.87	11.45	9.37			
MONTHLY DD	458	728	882	1037	1192	1090	1244	1399	1709			
ANNUAL DD	1092	2217	2947	3786	4736	5800	6992	8333	11462			
PARAMETER A	.471	.508	.514	.519	.526	.541	.587	.629	.690			
AZIMUTH AND TILT COEF.												
A1	-.0686	-.0729	-.0770	-.0818	-.0855	.0281	.0214	.0159	.0073			
A2	.2755	.4112	.4834	.5495	.6084	.6822	.6859	.7004	.7812			
A3	-.2228	-.3673	-.4441	-.5183	-.5888	-.6573	-.6825	-.7213	-.8620			
A4	.1232	.2178	.2668	.3135	.3576	.5228	.5266	.5397	.6094			
A5	.0781	.0869	.0924	.0941	.0917	.0254	.0150	.0025	-.0299			
B1	.0407	.0407	.0407	.0407	.0407	.0031	.0031	.0031	.0031			
B2	-1.1690	-1.1689	-1.1690	-1.1690	-1.1690	-1.1748	-1.1748	-1.1748	-1.1748			
B3	.7804	.7804	.7804	.7804	.7804	.8047	.8047	.8047	.8046			
B4	.6123	.6123	.6123	.6123	.6123	.5548	.5548	.5548	.5548			
B5	-1.2385	-1.2385	-1.2385	-1.2385	-1.2385	-1.2015	-1.2015	-1.2016	-1.2016			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 304290	QTA2 = 254147			QTA3 = 218547				
AZIMUTH AND TILT COEF.				C1 = -.0181	C2 = -.3391	C3 = -.2799	C4 = 1.5669	C5 = -1.2655				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	16	22	34	49	62	70	76	73	63	53	36	24
QHOR:	600	818	1251	1612	1906	2131	2105	1867	1281	1060	624	475

DODGE CITY, KANSAS				ELEVATION = 2582				LAT = 37.8				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	177.61	81.93	61.60	48.78	40.06	33.86	29.32	25.86	20.92			
VT2/DD	151.93	70.08	52.69	41.73	34.26	28.96	25.08	22.12	17.89			
VT3/DD	132.00	60.89	45.78	36.26	29.77	25.17	21.79	19.22	15.54			
MONTHLY DD	191	414	551	695	847	1002	1157	1312	1622			
ANNUAL DD	424	1254	1860	2580	3419	4392	5506	6775	9773			
PARAMETER A	.683	.611	.572	.541	.522	.514	.516	.521	.512			
AZIMUTH AND TILT COEF.												
A1	.0843	.1247	.1450	.1619	.1741	.1799	.1799	.1773	.1767			
A2	.1954	.3275	.4036	.4896	.5853	.6741	.7597	.8566	1.1491			
A3	-.2313	-.3557	-.4322	-.5297	-.6438	-.7528	-.8654	-.9994	-1.4118			
A4	.1678	.2572	.3115	.3761	.4488	.5161	.5827	.6603	.8983			
A5	-.0165	.0007	.0059	.0037	-.0025	-.0094	-.0217	-.0406	-.1033			
B1	-.0758	-.0758	-.0758	-.0758	-.0758	-.0758	-.0758	-.0758	-.0758			
B2	-1.1336	-1.1336	-1.1336	-1.1336	-1.1336	-1.1336	-1.1336	-1.1336	-1.1336			
B3	.7171	.7171	.7171	.7171	.7171	.7171	.7171	.7171	.7171			
B4	.7375	.7375	.7375	.7375	.7375	.7375	.7375	.7375	.7375			
B5	-1.3058	-1.3058	-1.3058	-1.3058	-1.3058	-1.3057	-1.3058	-1.3058	-1.3058			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 346492	QTA2 = 288809			QTA3 = 248071				
AZIMUTH AND TILT COEF.				C1 = -.0282	C2 = -.2826	C3 = -.4008	C4 = 1.7513	C5 = -1.3575				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	27	34	39	53	65	75	76	77	65	56	42	32
QHOR:	811	1092	1482	1908	2074	2337	2304	2115	1723	1304	871	717

GOODLAND, KANSAS

ELEVATION = 3688

LAT = 39.4

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	195.73	90.15	66.06	51.37	41.91	35.40	30.63	27.00	21.82			
VT2/DD	167.68	77.24	56.70	44.08	35.97	30.38	26.29	23.17	18.73			
VT3/DD	145.74	67.13	49.29	38.33	31.27	26.41	22.86	20.14	16.28			
MONTHLY DD	192	416	534	687	842	997	1152	1307	1617			
ANNUAL DD	550	1546	2267	3123	4115	5235	6499	7915	11090			
PARAMETER A	.573	.413	.422	.440	.444	.441	.436	.431	.396			
AZIMUTH AND TILT COEF.												
A1	.0691	.1232	.0220	.0283	.0338	.0381	.0407	.0414	.0414			
A2	.3236	.7208	1.1681	1.2272	1.3399	1.4890	1.6492	1.8133	2.3129			
A3	-.3610	-.7861	-1.0939	-1.1852	-1.3388	-1.5340	-1.7414	-1.9598	-2.6086			
A4	.1662	.3979	.6662	.7197	.8107	.9266	1.0506	1.1817	1.5741			
A5	.0471	.0941	.1696	.1528	.1339	.1154	.0976	.0739	.0084			
B1	-.0497	-.0497	-.0228	-.0228	-.0228	-.0228	-.0228	-.0228	-.0228			
B2	-1.1933	-1.1933	-1.2603	-1.2603	-1.2603	-1.2603	-1.2603	-1.2603	-1.2603			
B3	.7657	.7657	.8398	.8398	.8398	.8398	.8398	.8398	.8398			
B4	.6801	.6801	.5985	.5985	.5986	.5986	.5985	.5985	.5985			
B5	-1.3260	-1.3260	-1.3054	-1.3054	-1.3055	-1.3055	-1.3054	-1.3054	-1.3054			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 361783			QTA2 = 301995			QTA3 = 259503					
AZIMUTH AND TILT COEF.	C1 = -.0312			C2 = -.3623			C3 = -.3387					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	27	32	37	48	56	69	74	74	63	52	37	27
QHQR:	806	1045	1408	1913	2086	2343	2347	2125	1641	1275	813	693

TOPEKA, KANSAS

ELEVATION = 886

LAT = 39.1

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	117.30	62.44	48.17	38.00	30.63	25.53	21.88	19.14	15.31			
VT2/DD	100.35	53.42	41.21	32.54	26.23	21.86	18.73	16.39	13.11			
VT3/DD	87.18	46.41	35.80	28.27	22.79	18.99	16.28	14.24	11.39			
MONTHLY DD	248	466	605	624	774	929	1084	1239	1549			
ANNUAL DD	573	1386	1967	2665	3477	4405	5458	6673	9599			
PARAMETER A	.593	.514	.485	.501	.547	.590	.625	.655	.696			
AZIMUTH AND TILT COEF.												
A1	-.0556	-.0831	-.0932	.0337	.0292	.0263	.0249	.0245	.0246			
A2	.1604	.3724	.4606	.6179	.6084	.6104	.6315	.6729	.7987			
A3	-.1647	-.3717	-.4590	-.6187	-.6168	-.6306	-.6692	-.7356	-.9277			
A4	.0841	.2137	.2677	.4480	.4397	.4417	.4596	.4941	.5989			
A5	.0392	.0708	.0837	-.0035	-.0030	-.0058	-.0128	-.0244	-.0573			
B1	.0178	.0178	.0178	-.0201	-.0201	-.0201	-.0201	-.0201	-.0201			
B2	-1.1270	-1.1270	-1.1270	-1.1528	-1.1528	-1.1528	-1.1528	-1.1528	-1.1528			
B3	.7151	.7150	.7151	.7609	.7609	.7609	.7608	.7609	.7609			
B4	.7111	.7111	.7111	.6460	.6461	.6461	.6461	.6461	.6460			
B5	-1.2731	-1.2732	-1.2732	-1.2248	-1.2248	-1.2248	-1.2248	-1.2248	-1.2248			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 308146			QTA2 = 256995			QTA3 = 220856					
AZIMUTH AND TILT COEF.	C1 = -.0154			C2 = -.2875			C3 = -.3558					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	25	31	40	56	66	73	77	79	67	57	44	30
QHQR:	705	940	1280	1639	1975	2088	2159	1904	1484	1139	802	565

LEXINGTON, KENTUCKY

ELEVATION = 988

LAT = 38.0

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)			
VT1/DD	113.84	55.16	40.87	31.62	25.48	21.19	18.07	15.28	11.65			
VT2/DD	97.11	47.05	34.87	26.97	21.73	18.07	15.42	13.04	9.94			
VT3/DD	84.31	40.85	30.27	23.42	18.87	15.69	13.38	11.32	8.63			
MONTHLY DD	166	343	464	599	744	894	1048	993	1303			
ANNUAL DD	355	954	1454	2089	2862	3781	4862	6109	9178			
PARAMETER A	.451	.566	.586	.595	.600	.610	.628	.687	.787			
AZIMUTH AND TILT COEF.												
A1	.0534	.0436	.0428	.0422	.0418	.0408	.0393	-.0055	-.0041			
A2	.3465	.2827	.3135	.3549	.3986	.4405	.4800	.5279	.5746			
A3	-.3011	-.2611	-.3040	-.3571	-.4144	-.4740	-.5357	-.6510	-.7427			
A4	.1822	.1565	.1835	.2165	.2526	.2904	.3296	.4195	.4713			
A5	.1169	.0860	.0810	.0778	.0723	.0618	.0458	-.0543	-.0644			
B1	-.0288	-.0288	-.0288	-.0288	-.0288	-.0288	-.0288	-.0092	-.0092			
B2	-1.0028	-1.0028	-1.0028	-1.0028	-1.0028	-1.0028	-1.0028	-1.0152	-1.0152			
B3	.6511	.6511	.6511	.6511	.6511	.6511	.6511	.6890	.6890			
B4	.7624	.7623	.7623	.7623	.7623	.7623	.7623	.7209	.7209			
B5	-1.1860	-1.1859	-1.1859	-1.1859	-1.1859	-1.1860	-1.1859	-1.1366	-1.1366			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 251362			QTA2 = 209159			QTA3 = 179667					
AZIMUTH AND TILT COEF.	C1 = -.0191			C2 = -.2150			C3 = -.3901					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	31	34	43	57	62	72	75	73	69	57	45	37
QHQR:	547	761	1101	1510	1755	1924	1858	1736	1365	1078	632	444

LOUISVILLE, KENTUCKY

	T830	T840	T845	T850	T855	T860	T865	T870	T880
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)
VT1/DD	136.73	61.61	44.89	34.38	27.46	22.71	19.24	16.67	13.16
VT2/DD	116.67	52.57	38.30	29.34	23.43	19.38	16.42	14.23	11.23
VT3/DD	101.29	45.65	33.25	25.47	20.35	16.82	14.25	12.35	9.75
MONTHLY DD	142	314	432	563	705	853	1007	1162	1472
ANNUAL DD	263	871	1394	2044	2814	3716	4756	5966	8930
PARAMETER A	.631	.664	.636	.624	.622	.628	.640	.654	.686

ELEVATION = 489 LAT = 38.2

AZIMUTH AND TILT COEF.

A1	.0221	.0336	.0355	.0349	.0339	.0329	.0321	.0313	.0295
A2	-.1588	.2316	.2908	.3437	.3885	.4272	.4667	.5132	.6342
A3	-.1605	-.2511	-.3209	-.3843	-.4399	-.4915	-.5469	-.6150	-.7979
A4	.1289	.1825	.2272	.2675	.3030	.3353	.3697	.4110	.5181
A5	.0128	.0145	.0156	.0149	.0123	.0065	-.0020	-.0142	-.0493
B1	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206
B2	-1.0199	-1.0199	-1.0199	-1.0199	-1.0199	-1.0199	-1.0199	-1.0199	-1.0199
B3	.6739	.6739	.6739	.6739	.6739	.6739	.6739	.6739	.6739
B4	.7571	.7572	.7572	.7571	.7571	.7571	.7571	.7572	.7572
B5	-1.1838	-1.1838	-1.1838	-1.1838	-1.1838	-1.1838	-1.1838	-1.1838	-1.1838

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 252591 QTA2 = 210277 QTA3 = 180660

AZIMUTH AND TILT COEF. C1 = -.0108 C2 = -.2505 C3 = -.3469 C4 = 1.6789 C5 = -1.1611

MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	32	33	44	56	66	73	76	75	69	57	46	39
QHOR:	557	796	1148	1539	1699	1886	1794	1695	1386	1036	629	474

BATON ROUGE, LOUISIANA

	T830	T840	T845	T850	T855	T860	T865	T870	T880
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)
VT1/DD	NA	636.82	382.41	204.32	155.64	75.14	53.20	39.96	26.07
VT2/DD	NA	543.05	326.11	173.67	98.29	63.87	45.22	33.97	22.16
VT3/DD	NA	471.63	283.22	150.74	85.31	55.43	39.25	29.48	19.23
MONTHLY DD	14	39	66	113	199	307	433	577	884
ANNUAL DD	14	72	167	359	690	1169	1813	2643	5099
PARAMETER A	NA	.497	.474	.480	.491	.498	.505	.517	.596

ELEVATION = 75 LAT = 30.5

AZIMUTH AND TILT COEF.

A1	NA	.0931	.1433	-.0778	-.0641	-.0561	-.0481	-.0391	-.0175
A2	NA	.2243	.4529	.0838	.1731	.2340	.3121	.4104	.6217
A3	NA	-.2116	-.4545	-.1397	-.2367	-.3082	-.4076	-.5387	-.8405
A4	NA	.0809	.2036	.1299	.1832	.2246	.2814	.3532	.5047
A5	NA	.0656	.0978	-.0562	-.0469	-.0460	-.0509	-.0604	-.0872
B1	NA	-.0806	-.0806	-.0025	-.0025	-.0025	-.0025	-.0025	-.0025
B2	NA	-1.0487	-1.0487	-.9155	-.9155	-.9155	-.9155	-.9155	-.9155
B3	NA	.6280	.6280	.4913	.4913	.4913	.4913	.4913	.4913
B4	NA	.9179	.9179	1.0107	1.0108	1.0108	1.0108	1.0108	1.0108
B5	NA	-1.2642	-1.2642	-1.2336	-1.2336	-1.2337	-1.2336	-1.2336	-1.2336

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 257715 QTA2 = 214430 QTA3 = 184339

AZIMUTH AND TILT COEF. C1 = .0299 C2 = -.1411 C3 = -.4761 C4 = 1.8309 C5 = -1.1012

MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	51	52	60	68	73	79	80	80	76	69	58	51
QHOR:	790	1037	1316	1757	1920	1764	1748	1698	1451	1226	919	761

LAKE CHARLES, LOUISIANA

	T830	T840	T845	T850	T855	T860	T865	T870	T880
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)
VT1/DD	NA	852.26	357.16	170.23	97.97	64.63	46.79	35.42	23.18
VT2/DD	NA	725.88	303.38	144.60	83.22	54.90	39.75	30.09	19.69
VT3/DD	NA	630.24	263.28	125.49	72.22	47.65	34.49	26.11	17.09
MONTHLY DD	6	27	57	120	209	317	438	578	884
ANNUAL DD	7	64	155	329	629	1088	1700	2497	4883
PARAMETER A	NA	.407	.535	.607	.661	.652	.646	.650	.701

ELEVATION = 10 LAT = 30.1

AZIMUTH AND TILT COEF.

A1	NA	.2289	-.0609	-.0477	-.0386	-.0334	-.0272	-.0208	-.0085
A2	NA	.4980	.0558	.0741	.1072	.1787	.2526	.3288	.5182
A3	NA	-.4804	-.1065	-.1261	-.1692	-.2648	-.3616	-.4615	-.7196
A4	NA	.2914	.0911	.0959	.1156	.1660	.2191	.2747	.4131
A5	NA	.1096	-.0614	-.0543	-.0546	-.0619	-.0683	-.0746	-.0914
B1	NA	-.0987	-.0060	-.0060	-.0060	-.0060	-.0060	-.0060	-.0060
B2	NA	-.9870	-.8863	-.8863	-.8863	-.8863	-.8863	-.8863	-.8863
B3	NA	.5873	.4882	.4882	.4882	.4882	.4882	.4882	.4882
B4	NA	.9272	1.0149	1.0150	1.0150	1.0149	1.0150	1.0150	1.0149
B5	NA	-1.2415	-1.1995	-1.1995	-1.1995	-1.1995	-1.1996	-1.1995	-1.1995

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 249261 QTA2 = 207312 QTA3 = 178216

AZIMUTH AND TILT COEF. C1 = .0267 C2 = -.0845 C3 = -.5126 C4 = 1.8353 C5 = -1.0595

MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	51	54	60	67	74	79	81	80	77	67	61	51
QHOR:	729	1045	1296	1589	1871	2013	1774	1569	1468	1246	886	736

NEW ORLEANS, LOUISIANA												
ELEVATION = 10												
LAT = 30.0												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	963.99	439.33	229.37	137.65	91.60	63.96	46.83	29.44			
VT2/DD	NA	819.69	373.56	195.04	117.04	77.89	54.38	39.82	25.04			
VT3/DD	NA	711.52	324.27	169.30	101.60	67.61	47.21	34.56	21.73			
MONTHLY DD	2	25	54	104	173	260	372	508	808			
ANNUAL DD	2	45	124	280	544	940	1526	2323	4698			
PARAMETER A	NA	.518	.606	.628	.594	.566	.560	.565	.594			
AZIMUTH AND TILT COEF.												
A1	NA	-.0036	.0030	.0116	.0216	.0317	.0421	.0508	.0654			
A2	NA	-.0906	-.0240	-.0538	.1464	.2432	.3464	.4550	.7372			
A3	NA	.0808	.0067	-.0836	-.1951	-.3172	-.4548	-.6052	-1.0139			
A4	NA	-.0398	.0112	.0715	.1425	.2136	.2876	.3675	.5828			
A5	NA	-.0270	-.0288	-.0330	-.0392	-.0463	-.0563	-.0705	-.1161			
B1	NA	-.0577	-.0577	-.0577	-.0577	-.0577	-.0577	-.0577	-.0577			
B2	NA	-.9371	-.9371	-.9371	-.9371	-.9371	-.9371	-.9371	-.9371			
B3	NA	.5243	.5243	.5243	.5243	.5243	.5243	.5243	.5243			
B4	NA	1.0097	1.0097	1.0096	1.0097	1.0097	1.0097	1.0097	1.0097			
B5	NA	-1.2285	-1.2285	-1.2284	-1.2285	-1.2285	-1.2285	-1.2284	-1.2285			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL		QTA1 = 268094			QTA2 = 223086			QTA3 = 191787				
AZIMUTH AND TILT COEF.		C1 = .0188		C2 = -.1506		C3 = -.4857		C4 = 1.8632		C5 = -1.1251		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	53	54	60	69	74	78	80	81	74	71	60	55
QHOR:	818	1082	1423	1699	1958	1893	1780	1731	1537	1374	950	806

SHREVEPORT, LOUISIANA												
ELEVATION = 259												
LAT = 32.5												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	553.93	260.07	143.07	86.78	60.14	45.03	35.39	24.52			
VT2/DD	NA	472.66	221.91	122.08	73.86	51.18	38.32	30.12	20.87			
VT3/DD	NA	410.51	192.73	106.03	64.11	44.43	33.27	26.15	18.12			
MONTHLY DD	2	48	103	187	284	410	548	697	1006			
ANNUAL DD	3	111	293	627	1104	1709	2466	3393	5918			
PARAMETER A	NA	.580	.505	.448	.472	.479	.495	.516	.564			
AZIMUTH AND TILT COEF.												
A1	NA	-.0405	-.0518	-.0609	.0541	.0533	.0510	.0480	.0422			
A2	NA	-.2368	.4174	.6216	.2833	.3357	.3982	.4740	.7047			
A3	NA	-.2243	-.4269	-.6600	-.4082	-.4715	-.5507	-.6485	-.9625			
A4	NA	.1518	.2822	.4278	.2525	.2900	.3339	.3869	.5557			
A5	NA	.0405	.0450	.0497	-.0717	-.0720	-.0738	-.0765	-.0983			
B1	NA	-.0076	-.0076	-.0076	-.0437	-.0437	-.0437	-.0437	-.0437			
B2	NA	-1.0389	-1.0389	-1.0389	-.9446	-.9446	-.9446	-.9446	-.9446			
B3	NA	.6308	.6308	.6308	.5258	.5258	.5258	.5258	.5258			
B4	NA	.8380	.8380	.8380	.9363	.9363	.9363	.9363	.9363			
B5	NA	-1.2670	-1.2670	-1.2670	-1.2563	-1.2563	-1.2563	-1.2563	-1.2563			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL		QTA1 = 217362			QTA2 = 230686			QTA3 = 198185				
AZIMUTH AND TILT COEF.		C1 = -.0280		C2 = -.1261		C3 = -.5261		C4 = 1.8371		C5 = -1.1774		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	47	50	57	66	73	78	82	81	76	65	53	46
QHOR:	777	1027	1411	1550	1919	2098	2043	1877	1502	1255	914	756

BANGOR, MAINE												
ELEVATION = 203												
LAT = 44.8												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	62.25	33.47	26.71	22.20	18.89	16.25	14.26	12.70	10.42			
VT2/DD	53.02	28.68	22.89	19.02	16.20	13.93	12.23	10.89	8.94			
VT3/DD	46.01	24.92	19.89	16.53	14.08	12.11	10.62	9.46	7.77			
MONTHLY DD	385	607	761	916	954	1109	1264	1419	1729			
ANNUAL DD	1109	2370	3232	4229	5381	6692	8167	9780	13255			
PARAMETER A	.290	.394	.437	.473	.513	.565	.609	.642	.664			
AZIMUTH AND TILT COEF.												
A1	-.0672	.0906	.0801	.0709	-.0217	-.0216	-.0224	-.0240	-.0288			
A2	-.6687	.9005	.8902	.8981	.9701	.9458	.9396	.9597	1.0819			
A3	.4352	-.8232	-.8306	-.8597	-.8631	-.8766	-.9065	-.9623	-1.1541			
A4	-.4090	.4724	.4715	.4865	.6305	.6246	.6323	.6590	.7690			
A5	-.1472	.1843	.1732	.1589	.1501	.1225	.0966	.0723	.0311			
B1	.0321	-.0023	-.0023	-.0023	.0228	.0228	.0228	.0228	.0228			
B2	-.9553	-1.1854	-1.1854	-1.1854	-1.2002	-1.2002	-1.2002	-1.2002	-1.2001			
B3	.5492	.8291	.8291	.8291	.8487	.8487	.8487	.8487	.8487			
B4	.8278	.5690	.5690	.5690	.5104	.5104	.5104	.5104	.5104			
B5	-1.2321	-1.1921	-1.1921	-1.1921	-1.1755	-1.1756	-1.1756	-1.1756	-1.1755			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL		QTA1 = 267176			QTA2 = 223456			QTA3 = 192363				
AZIMUTH AND TILT COEF.		C1 = -.0142		C2 = -.3645		C3 = -.1894		C4 = 1.4786		C5 = -1.1996		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	20	16	27	41	52	62	67	66	58	46	38	24
QHOR:	463	777	1000	1467	1740	1851	1887	1633	1209	884	418	390

CARIBOU, MAINE												
ELEVATION = 623												
LAT = 46.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	30.10	19.22	15.84	13.47	11.72	10.36	9.29	8.42	7.09			
VT2/DD	25.74	16.47	13.57	11.54	10.04	8.88	7.96	7.22	6.08			
VT3/DD	22.36	14.31	11.80	10.03	8.72	7.72	6.92	6.27	5.28			
MONTHLY DD	560	725	879	1034	1189	1344	1499	1654	1964			
ANNUAL DD	1804	3285	4256	5369	6614	8011	9562	11228	14762			
PARAMETER A	.580	.674	.740	.793	.838	.879	.915	.939	.951			
AZIMUTH AND TILT COEF.												
A1	-.0620	.0423	.0417	.0407	.0395	.0379	.0364	.0353	.0346			
A2	.1112	.4036	.4054	.4129	.4246	.4384	.4569	.4855	.5720			
A3	-.1125	-.3509	-.3662	-.3856	-.4090	-.4358	-.4692	-.5149	-.6400			
A4	.1611	.3015	.3033	.3097	.3196	.3319	.3491	.3747	.4484			
A5	-.0613	.0460	.0390	.0330	.0269	.0194	.0102	-.0001	-.0216			
B1	.0489	.0141	.0141	.0141	.0141	.0141	.0141	.0141	.0141			
B2	-1.0812	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578	-1.1578			
B3	.7505	.8430	.8430	.8430	.8430	.8430	.8429	.8430	.8430			
B4	.5493	.4755	.4755	.4755	.4755	.4755	.4755	.4755	.4755			
B5	-1.1375	-1.1410	-1.1410	-1.1410	-1.1410	-1.1410	-1.1410	-1.1410	-1.1410			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	12	13	25	36	51	60	64	61	54	43	31	16
QHOR:	410	736	1171	1425	1617	1815	1746	1468	1028	687	378	308

PORTLAND, MAINE												
ELEVATION = 62												
LAT = 43.7												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	64.80	33.88	26.38	21.44	17.82	15.21	13.27	11.77	9.59			
VT2/DD	55.44	28.98	22.57	18.35	15.27	13.03	11.37	10.08	8.22			
VT3/DD	48.16	25.18	19.61	15.94	13.27	11.33	9.88	8.76	7.14			
MONTHLY DD	271	519	667	820	904	1059	1214	1369	1679			
ANNUAL DD	774	1831	2627	3583	4696	5975	7421	8997	12465			
PARAMETER A	.385	.501	.544	.575	.621	.663	.701	.726	.738			
AZIMUTH AND TILT COEF.												
A1	.1505	.1219	.1166	.1143	-.1041	-.0905	-.0792	-.0708	-.0601			
A2	.2482	.3455	.4036	.4681	.7696	.8861	.8082	.8471	.9823			
A3	-.2127	-.3280	-.3986	-.4795	-.7473	-.7895	-.8377	-.9033	-1.0993			
A4	.1950	.2522	.2914	.3372	.4968	.5168	.5405	.5757	.6864			
A5	.0259	.0330	.0336	.0314	.0917	.0758	.0597	.0444	.0142			
B1	-.0695	-.0695	-.0695	-.0695	.0137	.0137	.0137	.0137	.0137			
B2	-1.1214	-1.1214	-1.1214	-1.1214	-1.2016	-1.2016	-1.2016	-1.2016	-1.2016			
B3	.7598	.7598	.7597	.7598	.8542	.8542	.8542	.8542	.8542			
B4	.6294	.6294	.6294	.6294	.5509	.5509	.5509	.5509	.5509			
B5	-1.1787	-1.1787	-1.1787	-1.1787	-1.1726	-1.1726	-1.1727	-1.1726	-1.1726			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	23	24	34	42	52	63	68	66	59	49	39	25
QHOR:	439	680	1011	1250	1575	1711	1779	1488	1186	857	479	368

BALTIMORE, MARYLAND												
ELEVATION = 154												
LAT = 39.2												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	174.04	68.94	48.71	36.98	29.68	24.09	20.07	17.20	13.37			
VT2/DD	148.73	58.91	41.62	31.61	25.36	20.60	17.16	14.71	11.43			
VT3/DD	129.17	51.17	36.15	27.45	22.03	17.89	14.91	12.77	9.93			
MONTHLY DD	128	323	457	602	750	773	928	1083	1393			
ANNUAL DD	271	911	1479	2193	3036	4016	5136	6417	9503			
PARAMETER A	.463	.587	.603	.593	.581	.607	.641	.675	.726			
AZIMUTH AND TILT COEF.												
A1	.0786	.0752	.0770	.0808	.0830	-.1298	-.1215	-.1137	-.1028			
A2	.3347	.3233	.3693	.4392	.5284	.6683	.6996	.7260	.8148			
A3	-.3344	-.3470	-.4022	-.4846	-.5931	-.7550	-.8025	-.8460	-.9866			
A4	.1506	.1650	.2006	.2498	.3128	.4748	.5010	.5249	.6048			
A5	.0843	.0588	.0573	.0581	.0567	-.0129	-.0189	-.0269	-.0543			
B1	-.0406	-.0406	-.0406	-.0406	-.0406	.0410	.0410	.0410	.0410			
B2	-1.0932	-1.0932	-1.0932	-1.0932	-1.0932	-1.1174	-1.1174	-1.1174	-1.1174			
B3	.7171	.7171	.7171	.7171	.7171	.7602	.7602	.7602	.7602			
B4	.7363	.7363	.7363	.7363	.7363	.6740	.6739	.6740	.6739			
B5	-1.2173	-1.2173	-1.2174	-1.2174	-1.2173	-1.1764	-1.1764	-1.1764	-1.1763			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	30	34	42	51	61	72	76	74	68	57	46	35
QHOR:	597	824	1230	1493	1728	1940	1835	1586	1352	1053	674	490

PATUXENT RIVER, MARYLAND												
ELEVATION = 46												
LAT = 38.3												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	297.37	95.17	63.98	46.20	35.63	28.88	24.15	20.72	16.14			
VT2/DD	253.91	81.27	54.63	39.45	30.42	24.66	20.62	17.69	13.78			
VT3/DD	220.50	70.57	47.44	34.26	26.42	21.42	17.91	15.37	11.96			
MONTHLY DD	76	237	353	489	634	782	936	1091	1401			
ANNUAL DD	97	495	925	1512	2237	3098	4139	5363	8367			
PARAMETER A	.451	.659	.662	.626	.606	.591	.594	.606	.628			
AZIMUTH AND TILT COEF.												
A1	.0031	.0171	.0212	.0252	.0277	.0301	.0310	.0301	.0271			
A2	.0356	.0996	.1741	.2683	.3501	.4449	.5346	.6164	.7936			
A3	-.0381	-.1032	-.1865	-.2876	-.3783	-.4925	-.6047	-.7123	-.9556			
A4	.0282	.0865	.1388	.2016	.2565	.3229	.3864	.4468	.5837			
A5	.0006	.0023	.0059	.0148	.0204	.0196	.0162	.0087	-.0163			
B1	-.0181	-.0181	-.0181	-.0181	-.0181	-.0181	-.0181	-.0181	-.0181			
B2	-1.0579	-1.0579	-1.0579	-1.0579	-1.0579	-1.0579	-1.0579	-1.0579	-1.0579			
B3	.6729	.6729	.6729	.6729	.6729	.6729	.6729	.6729	.6729			
B4	.7663	.7663	.7663	.7663	.7663	.7663	.7663	.7663	.7663			
B5	-1.2124	-1.2124	-1.2124	-1.2124	-1.2124	-1.2124	-1.2123	-1.2124	-1.2124			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 270660			QTA2 = 225690			QTA3 = 194035			
AZIMUTH AND TILT COEF.												
C1 = -.0052			C2 = -.3040			C3 = -.2834			C4 = 1.6231			
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	34	38	46	54	64	73	77	76	71	60	48	39
QHOR:	629	906	1145	1562	1666	2007	1897	1694	1372	1037	712	567

BOSTON, MASSACHUSETTS												
ELEVATION = 16												
LAT = 42.4												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	126.94	48.07	33.95	26.19	21.27	17.86	15.38	13.51	10.86			
VT2/DD	108.50	41.09	29.02	22.38	18.18	15.27	13.15	11.55	9.28			
VT3/DD	94.22	35.68	25.20	19.44	15.79	13.26	11.42	10.03	8.06			
MONTHLY DD	135	357	506	656	808	962	1117	1272	1582			
ANNUAL DD	261	1040	1717	2537	3508	4643	5949	7410	10728			
PARAMETER A	.720	.690	.686	.691	.697	.706	.718	.731	.737			
AZIMUTH AND TILT COEF.												
A1	.1207	.2140	.2413	.2575	.2679	.2743	.2784	.2809	.2923			
A2	.0407	.2330	.2939	.3565	.4266	.4961	.5604	.6175	.7559			
A3	-.0808	-.2992	-.3640	-.4380	-.5250	-.6134	-.6964	-.7713	-.9592			
A4	.0490	.1814	.2210	.2658	.3184	.3717	.4212	.4658	.5771			
A5	-.0396	-.0309	-.0253	-.0270	-.0327	-.0401	-.0476	-.0551	-.0792			
B1	-.2002	-.2002	-.2002	-.2002	-.2002	-.2002	-.2002	-.2002	-.2002			
B2	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800			
B3	.7408	.7407	.7407	.7408	.7408	.7407	.7407	.7407	.7407			
B4	.6577	.6577	.6577	.6577	.6577	.6577	.6577	.6577	.6577			
B5	-1.1650	-1.1650	-1.1651	-1.1651	-1.1650	-1.1651	-1.1651	-1.1651	-1.1651			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 243348			QTA2 = 203130			QTA3 = 174713			
AZIMUTH AND TILT COEF.												
C1 = -.0039			C2 = -.3052			C3 = -.2438			C4 = 1.5616			
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	28	34	36	47	56	67	72	71	62	53	44	32
QHOR:	454	675	1029	1282	1620	1910	1725	1478	1288	835	502	385

ALPENA, MICHIGAN												
ELEVATION = 689												
LAT = 45.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	35.63	16.82	12.81	10.34	8.67	7.47	6.56	5.84	4.80			
VT2/DD	30.42	14.35	10.93	8.82	7.40	6.37	5.59	4.98	4.09			
VT3/DD	26.41	12.45	9.49	7.66	6.42	5.53	4.85	4.33	3.55			
MONTHLY DD	364	495	650	805	960	1115	1270	1425	1735			
ANNUAL DD	1118	2433	3313	4337	5495	6777	8206	9780	13228			
PARAMETER A	.477	.786	.907	.998	1.069	1.126	1.176	1.218	1.274			
AZIMUTH AND TILT COEF.												
A1	-.0416	-.0913	-.0735	-.0627	-.0556	-.0505	-.0464	-.0433	-.0394			
A2	.3542	.1441	.1308	.1283	.1334	.1415	.1507	.1617	.1908			
A3	-.3739	-.2104	-.1905	-.1872	-.1948	-.2062	-.2195	-.2356	-.2790			
A4	.2124	.1899	.1695	.1628	.1643	.1689	.1751	.1834	.2085			
A5	.0154	-.0991	-.0860	-.0805	-.0787	-.0783	-.0788	-.0805	-.0884			
B1	.0131	.0532	.0532	.0532	.0532	.0532	.0532	.0532	.0532			
B2	-1.0169	-.9744	-.9744	-.9744	-.9744	-.9744	-.9744	-.9744	-.9745			
B3	.6257	.6958	.6958	.6958	.6958	.6958	.6958	.6958	.6958			
B4	.6044	.6044	.6044	.6044	.6044	.6044	.6044	.6044	.6044			
B5	-1.0842	-1.0288	-1.0289	-1.0289	-1.0289	-1.0289	-1.0289	-1.0289	-1.0289			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 236263			QTA2 = 196800			QTA3 = 169126			
AZIMUTH AND TILT COEF.												
C1 = .0182			C2 = -.2352			C3 = -.3533			C4 = 1.6042			
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	19	17	28	41	51	64	67	68	56	49	36	24
QHOR:	367	598	1064	1415	1821	1883	1938	1577	1153	722	393	247

DETROIT, MICHIGAN

ELEVATION = 627										LAT = 42.4		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	95.96	36.39	25.53	19.45	15.61	12.96	11.06	9.64	7.68			
VT2/DD	81.38	31.07	21.80	16.61	13.32	11.06	9.44	8.23	6.56			
VT3/DD	70.56	26.97	18.92	14.42	11.57	9.60	8.20	7.15	5.69			
MONTHLY DD	185	321	458	601	749	903	1058	1213	1523			
ANNUAL DD	482	1429	2116	2923	3849	4915	6115	7469	10636			
PARAMETER A	.283	.448	.552	.630	.700	.767	.825	.880	.969			
AZIMUTH AND TILT COEF.												
A1	.0047	-.0932	-.0699	-.0568	-.0473	-.0398	-.0341	-.0297	-.0240			
A2	-1.0572	.5695	.4865	.4483	.4213	.4023	.3935	.3892	.4048			
A3	1.0485	-.7125	-.6032	-.5525	-.5188	-.4972	-.4895	-.4885	-.5216			
A4	-.5056	.3788	.3301	.3103	.2981	.2920	.2932	.2971	.3235			
A5	-.1716	-.0446	-.0360	-.0333	-.0337	-.0365	-.0412	-.0466	-.0632			
B1	.0086	.0369	.0369	.0369	.0369	.0369	.0369	.0369	.0369			
B2	-.7547	-1.0292	-1.0292	-1.0292	-1.0292	-1.0292	-1.0292	-1.0292	-1.0292			
B3	.3607	.7276	.7276	.7276	.7276	.7276	.7276	.7276	.7276			
B4	.9113	.6423	.6423	.6423	.6423	.6423	.6423	.6423	.6423			
B5	-1.1367	-1.0791	-1.0791	-1.0791	-1.0791	-1.0791	-1.0790	-1.0791	-1.0791			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL										QTA1 = 239317		
AZIMUTH AND TILT COEF.										C1 = .0255		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	26	26	35	49	61	69	74	71	67	56	42	30
QHOR:	424	690	969	1384	1732	1898	1891	1551	1297	833	491	338

FLINT, MICHIGAN

ELEVATION = 764										LAT = 43.0		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	48.49	26.05	20.48	16.06	13.09	11.04	9.54	8.41	6.79			
VT2/DD	41.41	22.25	17.50	13.72	11.18	9.43	8.15	7.18	5.80			
VT3/DD	35.96	19.32	15.19	11.91	9.71	8.19	7.08	6.23	5.03			
MONTHLY DD	303	564	718	880	990	1145	1300	1500	1610			
ANNUAL DD	816	1908	2681	3583	4617	5782	7101	8584	11941			
PARAMETER A	.590	.573	.564	.631	.698	.759	.817	.871	.944			
AZIMUTH AND TILT COEF.												
A1	-.0046	-.0328	-.0460	-.1141	-.1057	-.0983	-.0911	-.0845	-.0759			
A2	.3773	.4751	.5262	.5154	.4881	.4719	.4612	.4577	.4824			
A3	-.3741	-.4671	-.5186	-.5475	-.5250	-.5158	-.5135	-.5205	-.5728			
A4	.1951	.2567	.2890	.3596	.3424	.3346	.3317	.3348	.3663			
A5	.0683	.0895	.0983	.0199	.0158	.0098	.0023	-.0066	-.0278			
B1	.0299	.0299	.0299	.0563	.0563	.0563	.0563	.0563	.0563			
B2	-1.0444	-1.0444	-1.0444	-1.0458	-1.0458	-1.0458	-1.0458	-1.0458	-1.0458			
B3	.7152	.7152	.7152	.7393	.7394	.7394	.7393	.7393	.7394			
B4	.6618	.6618	.6618	.6205	.6205	.6205	.6205	.6205	.6205			
B5	-1.1232	-1.1231	-1.1231	-1.0862	-1.0862	-1.0861	-1.0861	-1.0861	-1.0861			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL										QTA1 = 226423		
AZIMUTH AND TILT COEF.										C1 = .0136		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	21	24	31	46	54	67	70	68	62	52	38	28
QHOR:	411	647	999	1313	1698	1831	1764	1523	1184	808	372	306

GRAND RAPIDS, MICHIGAN

ELEVATION = 804										LAT = 42.9		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	59.48	26.42	19.30	15.20	12.54	10.67	9.28	8.22	6.68			
VT2/DD	50.79	22.56	16.48	12.98	10.71	9.11	7.93	7.02	5.71			
VT3/DD	44.10	19.58	14.31	11.27	9.29	7.91	6.88	6.09	4.96			
MONTHLY DD	221	420	575	730	885	1040	1195	1350	1660			
ANNUAL DD	654	1793	2571	3469	4501	5654	6947	8393	11691			
PARAMETER A	.516	.634	.728	.798	.861	.915	.967	1.013	1.076			
AZIMUTH AND TILT COEF.												
A1	.1876	-.1232	-.1050	-.0941	-.0856	-.0794	-.0740	-.0696	-.0643			
A2	.3337	.3248	.3029	.2964	.2918	.2905	.2916	.2980	.3340			
A3	-.3626	-.4192	-.3901	-.3815	-.3760	-.3756	-.3794	-.3915	-.4497			
A4	.1937	.2715	.2527	.2470	.2438	.2444	.2479	.2565	.2947			
A5	-.0156	-.0664	-.0588	-.0556	-.0542	-.0548	-.0573	-.0621	-.0793			
B1	-.0409	.0715	.0715	.0715	.0715	.0715	.0715	.0715	.0715			
B2	-1.0328	-1.0229	-1.0229	-1.0229	-1.0229	-1.0229	-1.0229	-1.0229	-1.0229			
B3	.6918	.7168	.7168	.7168	.7168	.7168	.7168	.7168	.7168			
B4	.6612	.6227	.6227	.6227	.6227	.6227	.6227	.6227	.6227			
B5	-1.1184	-1.0846	-1.0846	-1.0846	-1.0846	-1.0846	-1.0846	-1.0846	-1.0846			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL										QTA1 = 242968		
AZIMUTH AND TILT COEF.										C1 = .0178		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	24	23	33	46	59	67	71	68	60	53	39	26
QHOR:	369	724	973	1468	1741	1966	1970	1681	1238	877	466	313

SAULT STE. MARIE, MICHIGAN

SAULT STE. MARIE, MICHIGAN												
ELEVATION = 725												
LAT = 46.5												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	21.63	14.11	12.00	10.45	9.24	8.29	7.52	6.87	5.87			
VT2/DD	18.50	12.07	10.26	8.93	7.90	7.09	6.43	5.88	5.02			
VT3/DD	16.06	10.48	8.92	7.76	6.87	6.16	5.58	5.11	4.36			
MONTHLY DD	576	883	1038	1193	1348	1503	1658	1813	2123			
ANNUAL DD	1687	3170	4119	5200	6444	7847	9407	11082	14621			
PARAMETER A	.762	.824	.847	.875	.910	.944	.975	.996	1.006			
AZIMUTH AND TILT COEF.												
A1	.0607	.0661	.0687	.0693	.0685	.0673	.0661	.0657	.0675			
A2	.1741	.2037	.2234	.2410	.2570	.2742	.2950	.3226	.3949			
A3	-.2281	-.2588	-.2799	-.2999	-.3189	-.3408	-.3691	-.4076	-.5076			
A4	.1058	.1300	.1462	.1622	.1779	.1950	.2155	.2418	.3075			
A5	-.0267	-.0242	-.0232	-.0235	-.0249	-.0276	-.0325	-.0395	-.0572			
B1	-.0567	-.0567	-.0567	-.0567	-.0567	-.0567	-.0567	-.0567	-.0567			
B2	-1.0798	-1.0798	-1.0798	-1.0798	-1.0798	-1.0798	-1.0798	-1.0798	-1.0798			
B3	.7656	.7656	.7656	.7656	.7656	.7656	.7656	.7656	.7656			
B4	.5853	.5853	.5853	.5853	.5853	.5853	.5853	.5853	.5853			
B5	-1.1149	-1.1149	-1.1149	-1.1149	-1.1149	-1.1149	-1.1149	-1.1149	-1.1149			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 236448	QTA2 = 197299			QTA3 = 169700					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	11	14	23	37	50	57	63	62	55	45	34	19
QHQR:	325	606	1057	1418	1695	1867	1910	1532	1040	661	339	265

TRAVERSE CITY, MICHIGAN

TRAVERSE CITY, MICHIGAN												
ELEVATION = 630												
LAT = 44.7												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	36.89	18.77	14.89	12.33	10.52	9.18	8.14	7.31	6.08			
VT2/DD	31.50	16.03	12.71	10.53	8.99	7.84	6.95	6.24	5.19			
VT3/DD	27.35	13.92	11.04	9.14	7.80	6.81	6.04	5.42	4.51			
MONTHLY DD	302	593	748	903	1058	1213	1368	1523	1833			
ANNUAL DD	883	2161	3016	4003	5115	6357	7743	9277	12668			
PARAMETER A	.650	.734	.756	.790	.823	.857	.891	.925	.969			
AZIMUTH AND TILT COEF.												
A1	.0133	.0161	.0170	.0167	.0159	.0146	.0133	.0120	.0100			
A2	.3264	.2992	.3083	.3108	.3170	.3276	.3396	.3522	.3944			
A3	-.3240	-.3096	-.3233	-.3306	-.3436	-.3630	-.3848	-.4080	-.4768			
A4	.1856	.1835	.1931	.1989	.2085	.2224	.2377	.2540	.3002			
A5	.0310	.0177	.0161	.0130	.0082	.0014	-.0064	-.0151	-.0358			
B1	.0110	.0110	.0110	.0110	.0110	.0110	.0110	.0110	.0110			
B2	-1.0243	-1.0243	-1.0243	-1.0243	-1.0243	-1.0243	-1.0243	-1.0243	-1.0243			
B3	.7076	.7076	.7076	.7076	.7076	.7076	.7076	.7076	.7076			
B4	.6234	.6234	.6234	.6234	.6234	.6234	.6234	.6234	.6234			
B5	-1.0943	-1.0943	-1.0943	-1.0943	-1.0943	-1.0943	-1.0943	-1.0943	-1.0943			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 226231	QTA2 = 188351			QTA3 = 161837					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	20	21	29	42	54	63	70	66	59	50	37	26
QHQR:	310	529	949	1374	1718	1908	1939	1584	1166	759	346	280

DULUTH, MINNESOTA

DULUTH, MINNESOTA												
ELEVATION = 1417												
LAT = 46.8												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	25.32	17.92	15.61	13.67	11.98	10.66	9.60	8.73	7.40			
VT2/DD	21.70	15.36	13.38	11.73	10.28	9.14	8.24	7.49	6.35			
VT3/DD	18.86	13.35	11.62	10.19	8.93	7.95	7.16	6.51	5.52			
MONTHLY DD	740	1045	1200	1098	1253	1408	1563	1718	2028			
ANNUAL DD	2107	3716	4704	5823	7081	8474	10013	11669	15196			
PARAMETER A	.640	.610	.611	.638	.689	.735	.775	.805	.827			
AZIMUTH AND TILT COEF.												
A1	.0406	.0383	.0351	-.1374	-.1261	-.1170	-.1097	-.1047	-.1019			
A2	.2359	.3803	.4387	.6797	.6716	.6707	.6776	.6992	.7862			
A3	-.2381	-.3616	-.4179	-.5412	-.5584	-.5814	-.6123	-.6583	-.7922			
A4	.1457	.2308	.2694	.4191	.4228	.4310	.4448	.4690	.5477			
A5	.0183	.0523	.0609	.1575	.1393	.1224	.1057	.0896	.0618			
B1	.0137	.0137	.0137	.0755	.0755	.0755	.0755	.0755	.0755			
B2	-1.1712	-1.1712	-1.1712	-1.2280	-1.2280	-1.2280	-1.2280	-1.2280	-1.2280			
B3	.8235	.8235	.8235	.8835	.8835	.8835	.8835	.8835	.8835			
B4	.5257	.5257	.5257	.4472	.4472	.4471	.4472	.4471	.4472			
B5	-1.1807	-1.1807	-1.1807	-1.1806	-1.1806	-1.1805	-1.1806	-1.1806	-1.1806			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 251930	QTA2 = 211002			QTA3 = 181791					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	6	13	22	36	49	58	65	63	55	45	28	14
QHQR:	413	670	1013	1324	1557	1765	1830	1510	1050	723	369	296

INTERNATIONAL FALLS, MINNESOTA

		ELEVATION = 1184								LAT = 48.6		
SOUTH-VERT. (M=1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
		(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)		
VT1/DD	19.05	14.15	12.42	10.86	9.63	8.65	7.84	7.17	6.13	5.26		
VT2/DD	16.35	12.14	10.65	9.32	8.26	7.42	6.72	6.15	4.57	2.129		
VT3/DD	14.21	10.55	9.26	8.10	7.18	6.45	5.84	5.35	4.57	15757		
MONTHLY DD	895	1205	1051	1202	1354	1509	1664	1819	1819	15757		
ANNUAL DD	2711	4331	5304	6402	7645	9040	10578	12229	15757	999		
PARAMETER A	.622	.659	.690	.751	.811	.868	.917	.956	.996	.999		
AZIMUTH AND TILT COEF.												
A1	.0246	.0276	-.0075	-.0069	-.0070	-.0073	-.0077	-.0081	-.0091	-.0091		
A2	.3728	.4315	-.3945	-.3880	-.3838	-.3843	-.3914	-.4072	-.4615	-.4615		
A3	-.3199	-.3724	-.3479	-.3504	-.3561	-.3672	-.3864	-.4159	-.5005	-.5005		
A4	.2064	.2383	.3145	.3041	.2975	.2962	.3015	.3147	.3606	.3606		
A5	.0717	.0867	.0244	.0233	.0205	.0162	.0102	.0027	-.0148	-.0148		
B1	-.0022	-.0022	.0118	.0118	.0118	.0118	.0118	.0118	.0118	.0118		
B2	-1.2227	-1.2227	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032		
B3	-.8770	-.8770	-.8737	-.8737	-.8737	-.8737	-.8737	-.8737	-.8737	-.8737		
B4	.4587	.4587	.4240	.4240	.4240	.4239	.4240	.4239	.4239	.4239		
B5	-1.1779	-1.1778	-1.1445	-1.1444	-1.1444	-1.1444	-1.1445	-1.1444	-1.1444	-1.1444		
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 266962 QTA2 = 223550 QTA3 = 192572												
AZIMUTH AND TILT COEF. C1 = -.0056 C2 = -.3520 C3 = -.1984 C4 = 1.4214 C5 = -1.2271												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	1	7	18	37	52	60	65	63	51	44	27	11
QHOR:	344	688	993	1415	1790	1882	1955	1645	1083	734	341	266

MINNEAPOLIS-ST. PAUL, MINNESOTA

		ELEVATION = 837								LAT = 44.9		
SOUTH-VERT. (M=1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
		(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)		
VT1/DD	34.40	21.09	17.18	14.48	12.51	11.01	9.84	8.89	7.45	6.38		
VT2/DD	29.48	18.06	14.71	12.40	10.71	9.43	8.42	7.61	6.38	5.54		
VT3/DD	25.62	15.69	12.78	10.77	9.31	8.19	7.32	6.61	5.54	1914		
MONTHLY DD	611	676	830	984	1139	1294	1449	1604	1604	12877		
ANNUAL DD	1578	2910	3731	4660	5706	6874	8179	9622	12877	1015		
PARAMETER A	.524	.646	.710	.769	.824	.874	.919	.959	.959	1.015		
AZIMUTH AND TILT COEF.												
A1	-.0347	-.0062	-.0029	-.0002	.0018	.0034	.0046	.0055	.0065	.0065		
A2	-.3586	-.2286	-.2416	-.2502	-.2589	-.2714	-.2874	-.3060	-.3564	-.3564		
A3	-.2816	-.2785	-.2857	-.2918	-.3016	-.3181	-.3398	-.3661	-.4395	-.4395		
A4	.1494	.2576	.2535	.2502	.2503	.2562	.2669	.2812	.3246	.3246		
A5	.1165	-.0879	-.0737	-.0642	-.0590	-.0570	-.0575	-.0603	-.0730	-.0730		
B1	.0127	.0069	.0069	.0069	.0069	.0069	.0069	.0069	.0069	.0069		
B2	-1.1787	-1.1277	-1.1277	-1.1277	-1.1277	-1.1277	-1.1277	-1.1277	-1.1277	-1.1277		
B3	.8086	.7975	.7975	.7975	.7975	.7975	.7975	.7975	.7975	.7975		
B4	.5615	.5297	.5297	.5297	.5297	.5297	.5297	.5297	.5297	.5297		
B5	-1.2117	-1.1361	-1.1361	-1.1361	-1.1361	-1.1361	-1.1361	-1.1361	-1.1361	-1.1361		
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 274061 QTA2 = 229062 QTA3 = 197098												
AZIMUTH AND TILT COEF. C1 = .0177 C2 = -.3695 C3 = -.2190 C4 = 1.5129 C5 = -1.2341												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	10	17	27	47	57	69	73	70	61	50	33	18
QHOR:	461	771	1140	1400	1759	1910	1958	1685	1246	874	468	338

ROCHESTER, MINNESOTA

		ELEVATION = 1319								LAT = 43.9		
SOUTH-VERT. (M=1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
		(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)		
VT1/DD	37.52	24.29	20.20	17.02	14.70	12.93	11.54	10.42	8.72	7.47		
VT2/DD	32.13	20.80	17.31	14.58	12.59	11.08	9.89	8.93	7.47	6.49		
VT3/DD	27.92	18.07	15.04	12.67	10.94	9.62	8.59	7.76	6.49	1907		
MONTHLY DD	551	851	823	977	1132	1287	1442	1597	1907	13136		
ANNUAL DD	1513	2843	3699	4656	5720	6909	8248	9762	13136	.841		
PARAMETER A	.591	.578	.600	.646	.687	.727	.766	.803	.803	.841		
AZIMUTH AND TILT COEF.												
A1	.0478	.0519	-.1185	-.1073	-.0984	-.0911	-.0852	-.0803	-.0765	-.0765		
A2	.2110	.3283	.5130	.5146	.5215	.5325	.5463	.5650	.6460	.6460		
A3	-.1698	-.2700	-.5110	-.5159	-.5309	-.5530	-.5797	-.6143	-.7387	-.7387		
A4	.1449	.2142	.3288	.3323	.3417	.3555	.3723	.3938	.4705	.4705		
A5	.0385	.0643	.0381	.0373	.0324	.0253	.0167	.0060	-.0216	-.0216		
B1	.0102	.0102	.0700	.0700	.0700	.0700	.0700	.0700	.0700	.0700		
B2	-1.1373	-1.1373	-1.1720	-1.1720	-1.1720	-1.1720	-1.1720	-1.1720	-1.1720	-1.1720		
B3	.7654	.7654	.8317	.8318	.8317	.8318	.8318	.8318	.8318	.8318		
B4	.5882	.5882	.5411	.5411	.5411	.5411	.5411	.5411	.5411	.5411		
B5	-1.2018	-1.2018	-1.1704	-1.1704	-1.1704	-1.1704	-1.1704	-1.1704	-1.1704	-1.1704		
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 265526 QTA2 = 221894 QTA3 = 190907												
AZIMUTH AND TILT COEF. C1 = .0254 C2 = -.3569 C3 = -.2192 C4 = 1.5159 C5 = -1.2220												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	12	19	27	46	57	66	70	67	57	49	33	18
QHOR:	477	771	1073	1421	1629	1894	1930	1648	1190	821	486	379

JACKSON, MISSISSIPPI												
ELEVATION = 331												
LAT = 32.3												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	406.53	202.20	113.76	72.43	50.86	38.37	30.45	21.44			
VT2/DD	NA	346.98	172.03	96.79	61.62	43.27	32.64	25.91	18.24			
VT3/DD	NA	301.36	149.32	84.01	53.49	37.56	28.33	22.49	15.84			
MONTHLY DD	8	64	111	197	310	441	585	737	1047			
ANNUAL DD	18	195	413	757	1238	1851	2600	3528	6096			
PARAMETER A	NA	.423	.507	.592	.626	.638	.644	.654	.704			
AZIMUTH AND TILT COEF.												
A1	NA	-.1314	.0782	.0623	.0555	.0519	.0491	.0461	.0395			
A2	NA	.6214	.1448	.1791	.2220	.2681	.3217	.3825	.5353			
A3	NA	-.5891	-.2661	-.2995	-.3500	-.4076	-.4768	-.5574	-.7700			
A4	NA	.3844	.1399	.1611	.1914	.2251	.2650	.3116	.4327			
A5	NA	.1295	-.0744	-.0680	-.0671	-.0687	-.0722	-.0780	-.1001			
B1	NA	.0258	-.0398	-.0398	-.0398	-.0398	-.0398	-.0398	-.0398			
B2	NA	-1.0579	-.9459	-.9459	-.9459	-.9459	-.9459	-.9459	-.9459			
B3	NA	.6546	.5445	.5445	.5444	.5445	.5445	.5445	.5445			
B4	NA	.8432	.9589	.9589	.9589	.9589	.9589	.9589	.9589			
B5	NA	-1.2755	-1.2445	-1.2445	-1.2445	-1.2445	-1.2444	-1.2445	-1.2445			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 276008												
AZIMUTH AND TILT COEF. C1 = -.0097												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	46	49	55	65	72	78	80	79	75	65	54	46
QHQR:	731	1067	1376	1731	1948	1921	1860	1801	1535	1287	890	735

MERIDIAN, MISSISSIPPI												
ELEVATION = 308												
LAT = 32.3												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	1818.97	291.61	168.85	100.17	65.57	46.94	35.82	28.71	20.45			
VT2/DD	1534.40	245.99	142.43	85.19	55.77	39.92	30.46	24.41	17.39			
VT3/DD	1328.76	213.02	123.35	73.94	48.40	34.65	26.44	21.19	15.10			
MONTHLY DD	12	74	128	220	336	469	615	768	1078			
ANNUAL DD	30	243	474	825	1309	1950	2763	3747	6402			
PARAMETER A	.391	.534	.465	.503	.563	.604	.624	.630	.659			
AZIMUTH AND TILT COEF.												
A1	-.0372	-.0224	-.0298	.0100	.0056	.0016	-.0020	-.0057	-.0119			
A2	-.6353	-.5640	-.6074	.3082	.3093	.3233	.3613	.4294	.6033			
A3	.6619	.5654	.6012	-.4058	-.4111	-.4335	-.4894	-.5857	-.8344			
A4	-.4311	-.3772	-.4065	.2666	.2646	.2769	.3110	.3677	.5054			
A5	-.0828	-.0889	-.1006	-.0359	-.0383	-.0436	-.0534	-.0656	-.0940			
B1	.0389	.0389	.0389	.0214	.0214	.0214	.0214	.0214	.0214			
B2	-.6891	-.6892	-.6892	-.9233	-.9233	-.9233	-.9233	-.9233	-.9234			
B3	.2072	.2072	.2072	.5290	.5290	.5290	.5290	.5290	.5290			
B4	1.2607	1.2607	1.2607	.9562	.9562	.9562	.9562	.9562	.9562			
B5	-1.2467	-1.2467	-1.2467	-1.2288	-1.2288	-1.2288	-1.2288	-1.2288	-1.2288			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 262790												
AZIMUTH AND TILT COEF. C1 = .0128												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	45	47	55	65	71	78	80	79	74	62	53	47
QHQR:	728	996	1312	1721	1831	1957	1879	1815	1470	1203	873	698

COLUMBIA, MISSOURI												
ELEVATION = 886												
LAT = 38.8												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	133.67	62.99	47.29	35.52	28.14	23.22	19.72	17.12	13.55			
VT2/DD	114.29	53.85	40.43	30.40	24.08	19.87	16.88	14.65	11.60			
VT3/DD	99.27	46.77	35.12	26.41	20.92	17.27	14.66	12.73	10.07			
MONTHLY DD	170	361	481	567	716	867	1021	1176	1486			
ANNUAL DD	437	1185	1750	2437	3243	4178	5263	6520	9548			
PARAMETER A	.466	.465	.465	.525	.572	.608	.646	.681	.730			
AZIMUTH AND TILT COEF.												
A1	.0336	.0559	.0668	.0929	.0899	.0880	.0853	.0825	.0789			
A2	.2676	.4044	.4653	.5925	.5942	.6099	.6254	.6511	.7575			
A3	-.2897	-.4362	-.5042	-.6029	-.6187	-.6505	-.6835	-.7319	-.9072			
A4	.1446	.2377	.2785	.4610	.4603	.4710	.4817	.5016	.5875			
A5	.0202	.0250	.0256	.0125	.0050	.0036	-.0130	-.0258	-.0643			
B1	-.0359	-.0359	-.0359	-.0441	-.0441	-.0441	-.0441	-.0441	-.0441			
B2	-1.1360	-1.1360	-1.1360	-1.1645	-1.1645	-1.1645	-1.1645	-1.1645	-1.1645			
B3	.7560	.7559	.7559	.8089	.8088	.8089	.8089	.8088	.8089			
B4	.7578	.7578	.7578	.6755	.6755	.6755	.6755	.6755	.6755			
B5	-1.2303	-1.2303	-1.2303	-1.2061	-1.2061	-1.2061	-1.2061	-1.2061	-1.2061			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 281039												
AZIMUTH AND TILT COEF. C1 = -.0054												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	31	32	40	55	65	73	76	75	66	56	45	32
QHQR:	610	808	1160	1553	1986	1996	2110	1866	1446	1097	710	510

SPRINGFIELD, MISSOURI

		ELEVATION = 1270								LAT = 37.2
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
VT1/DD	317.02	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)
VT2/DD	271.43	104.58	69.95	51.34	40.09	32.64	27.34	23.47	20.05	18.30
VT3/DD	235.85	89.31	59.73	43.84	34.23	27.87	23.34	20.27	17.41	15.63
MONTHLY DD	82	77.56	51.88	38.07	29.73	24.20	20.27	17.41	13.57	1407
ANNUAL DD	258	246	368	502	643	789	942	1097	1407	1407
PARAMETER A	.356	.404	.463	.477	.482	.486	.493	.506	.518	.518
AZIMUTH AND TILT COEF.										
A1	.0327	.0061	.0049	.0047	.0044	.0039	.0039	.0039	.0047	.0095
A2	1.0569	.4271	.4156	.4658	.5352	.6089	.6864	.7663	.8463	1.0067
A3	-.9508	-.4909	-.4825	-.5460	-.6326	-.7247	-.8266	-.9368	-1.0543	-1.2786
A4	.6098	.3751	.3605	.3966	.4470	.5002	.5565	.6143	.6733	.7333
A5	.1827	.0011	-.0025	-.0056	-.0085	-.0110	-.0172	-.0270	-.0396	-.0685
B1	-.0493	-.0469	-.0469	-.0469	-.0469	-.0469	-.0469	-.0469	-.0469	-.0469
B2	-1.1727	-1.0616	-1.0616	-1.0616	-1.0616	-1.0616	-1.0616	-1.0616	-1.0616	-1.0616
B3	-.7756	.6645	.6645	.6645	.6645	.6645	.6645	.6645	.6645	.6645
B4	.6910	.7808	.7808	.7808	.7808	.7808	.7808	.7808	.7808	.7808
B5	-1.2618	-1.2611	-1.2611	-1.2611	-1.2611	-1.2611	-1.2611	-1.2611	-1.2611	-1.2611
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 287976			QTA2 = 239841			QTA3 = 206019		
AZIMUTH AND TILT COEF.		C1 = -.0424			C2 = -.2531			C3 = -.4050		
MONTH:	JAN FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
TAVE:	34 36	42	55	65	72	77	75	68	56	47
QHOR:	690 900	1243	1625	1869	2060	2105	1956	1483	1007	790

ST. LOUIS, MISSOURI

		ELEVATION = 564								LAT = 38.8
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
VT1/DD	179.56	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)
VT2/DD	153.42	64.37	45.41	34.17	27.05	22.23	18.84	16.34	13.97	12.92
VT3/DD	133.25	55.04	38.83	29.22	23.13	19.01	16.11	13.97	11.05	9.59
MONTHLY DD	139	47.81	33.73	25.38	20.09	16.51	13.99	12.14	9.59	1480
ANNUAL DD	385	297	421	559	707	860	1015	1170	1480	1480
PARAMETER A	.196	.510	.575	.626	.663	.695	.722	.748	.805	.805
AZIMUTH AND TILT COEF.										
A1	-.0490	.0902	.0825	.0789	.0786	.0782	.0780	.0775	.0775	.0753
A2	.7140	.4463	.4572	.4554	.4608	.4712	.4925	.5196	.5492	.5892
A3	-.6085	-.4048	-.4333	-.4429	-.4595	-.4830	-.5203	-.5660	-.6143	-.6647
A4	.3303	.3478	.3571	.3574	.3642	.3751	.3944	.4184	.4466	.4783
A5	.2316	.0123	.0078	.0038	-.0016	-.0084	-.0168	-.0267	-.0384	-.0516
B1	-.0523	-.0838	-.0838	-.0838	-.0838	-.0838	-.0838	-.0838	-.0838	-.0838
B2	-1.0761	-1.0984	-1.0984	-1.0984	-1.0984	-1.0984	-1.0984	-1.0984	-1.0984	-1.0984
B3	.6852	.7240	.7240	.7240	.7240	.7240	.7240	.7240	.7240	.7240
B4	.7408	.6684	.6684	.6684	.6684	.6684	.6684	.6684	.6684	.6684
B5	-1.2289	-1.1894	-1.1894	-1.1894	-1.1894	-1.1894	-1.1894	-1.1894	-1.1894	-1.1894
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 282726			QTA2 = 235480			QTA3 = 202275		
AZIMUTH AND TILT COEF.		C1 = -.0246			C2 = -.2614			C3 = -.3767		
MONTH:	JAN FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
TAVE:	32 33	41	56	66	74	78	76	69	58	43
QHOR:	665 866	1223	1578	1862	2130	2119	1884	1403	1063	701

BILLINGS, MONTANA

		ELEVATION = 3570								LAT = 45.8
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
VT1/DD	65.77	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)
VT2/DD	56.49	39.09	31.41	25.93	22.02	19.13	16.90	15.14	12.53	10.76
VT3/DD	49.11	33.57	26.98	22.27	18.91	16.43	14.52	13.01	11.31	9.36
MONTHLY DD	343	29.19	23.45	19.36	16.44	14.28	12.62	11.31	9.36	1799
ANNUAL DD	1011	577	718	869	1024	1179	1334	1489	1799	1799
PARAMETER A	.558	.641	.652	.664	.681	.700	.718	.731	.734	.734
AZIMUTH AND TILT COEF.										
A1	-.0232	-.0066	-.0003	.0052	.0096	.0130	.0155	.0175	.0211	.0211
A2	.4369	.5529	.6261	.6848	.7303	.7722	.8166	.8661	1.0005	1.0005
A3	-.3250	-.4508	-.5298	-.5969	-.6551	-.7156	-.7829	-.8581	-1.0497	-1.0497
A4	.2406	.3145	.3616	.4013	.4356	.4716	.5119	.5574	.6046	.6466
A5	.1219	.1293	.1343	.1357	.1315	.1209	.1064	.0895	.0538	.0538
B1	-.0098	-.0098	-.0098	-.0098	-.0098	-.0098	-.0098	-.0098	-.0098	-.0098
B2	-1.2784	-1.2784	-1.2784	-1.2784	-1.2784	-1.2784	-1.2784	-1.2784	-1.2784	-1.2784
B3	.9134	.9134	.9134	.9134	.9134	.9134	.9134	.9134	.9134	.9134
B4	.4570	.4570	.4570	.4570	.4570	.4570	.4570	.4570	.4570	.4570
B5	-1.2176	-1.2176	-1.2176	-1.2176	-1.2176	-1.2176	-1.2176	-1.2176	-1.2176	-1.2176
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 325458			QTA2 = 272347			QTA3 = 234387		
AZIMUTH AND TILT COEF.		C1 = .0190			C2 = -.3867			C3 = -.2307		
MONTH:	JAN FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
TAVE:	23 27	33	42	56	63	72	72	59	51	36
QHOR:	496 757	1145	1508	1863	2281	2333	2065	1473	1006	570

CUT BANK, MONTANA				ELEVATION = 3839				LAT = 48.6				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	42.60	28.48	23.81	20.02	17.16	14.99	13.30	11.95	9.94			
VT2/DD	36.58	24.48	20.46	17.21	14.75	12.88	11.43	10.27	8.54			
VT3/DD	31.80	21.29	17.79	14.96	12.82	11.20	9.94	8.93	7.43			
MONTHLY DD	514	642	768	913	1065	1219	1374	1529	1839			
ANNUAL DD	1571	2884	3810	4914	6180	7597	9135	10772	14257			
PARAMETER A	.588	.669	.696	.741	.786	.825	.853	.868	.870			
AZIMUTH AND TILT COEF.												
A1	.0005	.0125	.0121	.0108	.0095	.0083	.0075	.0070	.0068			
A2	.1881	.4810	.5378	.5655	.5882	.6151	.6525	.7018	.8250			
A3	-.1771	-.3681	-.4362	-.4831	-.5272	-.5770	-.6382	-.7124	-.8844			
A4	.1138	.2863	.3236	.3456	.3664	.3916	.4249	.4670	.5682			
A5	.0352	.1006	.1008	.0923	.0810	.0679	.0538	.0395	.0125			
B1	.0029	-.0007	-.0007	-.0007	-.0007	-.0007	-.0007	-.0007	-.0007			
B2	-1.2598	-1.3062	-1.3062	-1.3062	-1.3062	-1.3062	-1.3062	-1.3062	-1.3062			
B3	.8996	.9511	.9511	.9511	.9511	.9511	.9511	.9511	.9511			
B4	.4547	.3932	.3932	.3933	.3933	.3932	.3932	.3933	.3933			
B5	-1.2103	-1.1940	-1.1940	-1.1941	-1.1941	-1.1940	-1.1941	-1.1941	-1.1941			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 318994	QTA2 = 267446			QTA3 = 230418					
AZIMUTH AND TILT COEF.			C1 = .0064	C2 = -.4133	C3 = -.1864	C4 = 1.4216	C5 = -1.2990					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	15	21	29	38	49	58	64	63	52	46	29	20
QHQR:	414	686	1124	1490	1863	2019	2330	1922	1349	894	476	322

DILLON, MONTANA				ELEVATION = 5210				LAT = 45.3				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	78.75	42.72	33.99	27.95	23.71	20.59	18.19	16.29	13.48			
VT2/DD	67.56	36.65	29.20	24.01	20.36	17.68	15.62	14.00	11.58			
VT3/DD	58.72	31.86	25.39	20.87	17.71	15.37	13.58	12.17	10.07			
MONTHLY DD	328	605	713	867	1022	1177	1332	1487	1797			
ANNUAL DD	1030	2374	3311	4404	5655	7058	8581	10195	13644			
PARAMETER A	.577	.600	.623	.649	.667	.680	.684	.679	.648			
AZIMUTH AND TILT COEF.												
A1	-.0615	-.0564	.0752	.0747	.0753	.0764	.0786	.0821	.0919			
A2	.3567	.4773	.7300	.7832	.8444	.9125	.9960	1.0959	1.3404			
A3	-.3549	-.4668	-.6436	-.7190	-.8051	-.9037	-1.0220	-1.1588	-1.4822			
A4	.2073	.2802	.4340	.4769	.5268	.5841	.6539	.7355	.9308			
A5	.0428	.0620	.1352	.1239	.1109	.0933	.0732	.0530	.0126			
B1	.0304	.0304	-.0158	-.0158	-.0158	-.0158	-.0158	-.0158	-.0158			
B2	-1.2332	-1.2332	-1.2863	-1.2863	-1.2863	-1.2863	-1.2863	-1.2863	-1.2863			
B3	.8526	.8526	.9186	.9186	.9186	.9186	.9186	.9186	.9186			
B4	.5382	.5382	.4692	.4692	.4692	.4692	.4692	.4692	.4692			
B5	-1.2354	-1.2354	-1.2270	-1.2270	-1.2270	-1.2270	-1.2270	-1.2270	-1.2270			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 332749	QTA2 = 278271			QTA3 = 239391					
AZIMUTH AND TILT COEF.			C1 = .0620	C2 = -.3724	C3 = -.2626	C4 = 1.5403	C5 = -1.3243					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	20	26	29	40	50	58	65	64	53	44	34	22
QHQR:	527	797	1264	1570	2064	2203	2401	2038	1521	970	585	452

GLASGOW, MONTANA				ELEVATION = 2297				LAT = 48.2				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	34.73	22.37	18.81	16.22	14.26	12.72	11.48	10.46	8.89			
VT2/DD	29.77	19.18	16.12	13.90	12.22	10.90	9.84	8.97	7.62			
VT3/DD	25.87	16.67	14.01	12.08	10.62	9.48	8.55	7.79	6.62			
MONTHLY DD	526	817	971	1127	1282	1437	1592	1747	2057			
ANNUAL DD	1864	3285	4180	5188	6329	7589	8984	10508	13825			
PARAMETER A	.733	.719	.730	.751	.777	.805	.833	.858	.886			
AZIMUTH AND TILT COEF.												
A1	-.0275	-.0276	-.0272	-.0267	-.0260	-.0255	-.0248	-.0242	-.0235			
A2	.2300	.2690	.2905	.3103	.3294	.3496	.3720	.3983	.4730			
A3	-.2562	-.3033	-.3274	-.3498	-.3717	-.3960	-.4247	-.4603	-.5632			
A4	.1729	.2055	.2224	.2378	.2526	.2684	.2864	.3079	.3700			
A5	-.0236	-.0295	-.0304	-.0308	-.0313	-.0325	-.0353	-.0400	-.0555			
B1	.0348	.0348	.0348	.0348	.0348	.0348	.0348	.0348	.0348			
B2	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869			
B3	.8389	.8389	.8389	.8389	.8389	.8389	.8389	.8389	.8389			
B4	.4912	.4913	.4912	.4913	.4913	.4912	.4912	.4912	.4913			
B5	-1.1670	-1.1670	-1.1670	-1.1670	-1.1671	-1.1670	-1.1670	-1.1670	-1.1671			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 307828	QTA2 = 258007			QTA3 = 222288					
AZIMUTH AND TILT COEF.			C1 = .0304	C2 = -.4065	C3 = -.1726	C4 = 1.4195	C5 = -1.2703					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	13	15	26	38	55	65	72	68	58	45	27	18
QHQR:	393	694	1127	1449	1904	2009	2200	1820	1324	887	491	328

GREAT FALLS, MONTANA												
ELEVATION = 3661												
LAT = 47.5												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	52.28	34.61	28.54	23.87	20.33	17.64	15.58	13.94	11.53			
VT2/DD	44.83	29.68	24.48	20.47	17.43	15.13	13.36	11.96	9.89			
VT3/DD	38.97	25.80	21.28	17.79	15.15	13.15	11.61	10.39	8.59			
MONTHLY DD	394	595	722	864	1014	1168	1323	1478	1788			
ANNUAL DD	1126	2183	2940	3877	4994	6272	7697	9239	12598			
PARAMETER A	.798	.812	.797	.781	.779	.784	.791	.794	.781			
AZIMUTH AND TILT COEF.												
A1	-.0708	-.0578	-.0524	-.0482	-.0436	-.0390	-.0348	-.0313	-.0259			
A2	.2332	.3271	.3885	.4496	.5000	.5451	.5924	.6470	.7853			
A3	-.1891	-.2896	-.3562	-.4239	-.4841	-.5433	-.6087	-.6845	-.8717			
A4	.1097	.1748	.2179	.2616	.3009	.3392	.3811	.4293	.5479			
A5	.0658	.0680	.0693	.0697	.0661	.0583	.0473	.0343	.0054			
B1	.0224	.0224	.0224	.0224	.0224	.0224	.0224	.0224	.0224			
B2	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032	-1.2032			
B3	.8509	.8509	.8509	.8509	.8509	.8509	.8509	.8509	.8509			
B4	.4948	.4949	.4949	.4948	.4949	.4949	.4949	.4949	.4948			
B5	-1.2043	-1.2043	-1.2043	-1.2043	-1.2043	-1.2043	-1.2043	-1.2043	-1.2043			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA1 = 312480		QTA2 = 261571		QTA3 = 225209			
AZIMUTH AND TILT COEF.												
C1 = .0431			C2 = -.3796			C3 = -.2111		C4 = 1.4754		C5 = -1.2967		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	22	26	32	42	53	62	71	66	57	44	36	29
QHOR:	420	717	1155	1515	1805	2088	2375	1931	1352	906	504	354

HELENA, MONTANA												
ELEVATION = 3898												
LAT = 46.6												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	47.13	28.35	22.93	19.21	16.52	14.50	12.91	11.64	9.60			
VT2/DD	40.37	24.29	19.64	16.46	14.15	12.42	11.06	9.97	8.23			
VT3/DD	35.08	21.10	17.07	14.30	12.30	10.79	9.61	8.66	7.15			
MONTHLY DD	389	646	798	953	1108	1263	1418	1573	1778			
ANNUAL DD	1058	2253	3124	4154	5334	6673	8148	9725	13118			
PARAMETER A	.656	.755	.783	.807	.830	.852	.868	.877	.887			
AZIMUTH AND TILT COEF.												
A1	.0276	.0262	.0252	.0243	.0236	.0230	.0226	.0227	.0186			
A2	.0973	.1857	.2334	.2801	.3236	.3667	.4122	.4618	.7086			
A3	-.1137	-.2055	-.2597	-.3137	-.3656	-.4204	-.4807	-.5476	-.7857			
A4	.0776	.1387	.1737	.2083	.2414	.2760	.3141	.3563	.5167			
A5	-.0088	-.0056	-.0069	-.0089	-.0121	-.0183	-.0273	-.0385	-.0184			
B1	-.0033	-.0033	-.0033	-.0033	-.0033	-.0033	-.0033	-.0033	-.0009			
B2	-1.1561	-1.1561	-1.1561	-1.1561	-1.1561	-1.1561	-1.1561	-1.1561	-1.2253			
B3	.8058	.8059	.8059	.8059	.8059	.8059	.8059	.8058	.8795			
B4	.5367	.5367	.5367	.5367	.5367	.5367	.5367	.5367	.4664			
B5	-1.1690	-1.1690	-1.1690	-1.1690	-1.1690	-1.1690	-1.1690	-1.1690	-1.1684			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA1 = 302571		QTA2 = 253030		QTA3 = 217741			
AZIMUTH AND TILT COEF.												
C1 = .0260			C2 = -.3607			C3 = -.2433		C4 = 1.5198		C5 = -1.2899		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	19	27	32	41	53	60	70	66	54	46	34	22
QHOR:	416	688	1111	1437	1873	2017	2337	1944	1465	928	522	352

LEWISTOWN, MONTANA												
ELEVATION = 4147												
LAT = 47.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	50.09	31.43	25.38	21.00	17.88	15.55	13.76	12.34	10.23			
VT2/DD	42.96	26.96	21.77	18.01	15.33	13.34	11.80	10.59	8.78			
VT3/DD	37.34	23.43	18.92	15.66	13.33	11.59	10.26	9.20	7.63			
MONTHLY DD	370	590	730	883	1037	1192	1347	1502	1812			
ANNUAL DD	1063	2249	3136	4207	5440	6832	8344	9954	13394			
PARAMETER A	.819	.810	.806	.816	.832	.848	.856	.856	.836			
AZIMUTH AND TILT COEF.												
A1	.0766	.0914	.0958	.0969	.0962	.0949	.0942	.0944	.0971			
A2	.2326	.3497	.4084	.4543	.4947	.5381	.5890	.6481	.7862			
A3	-.1908	-.3266	-.3981	-.4584	-.5145	-.5761	-.6478	-.7295	-.9149			
A4	.1429	.2222	.2642	.2989	.3311	.3666	.4084	.4567	.5681			
A5	.0548	.0544	.0514	.0453	.0373	.0275	.0160	.0037	-.0211			
B1	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206	-.0206			
B2	-1.2104	-1.2104	-1.2104	-1.2104	-1.2104	-1.2104	-1.2104	-1.2104	-1.2104			
B3	.8547	.8547	.8547	.8548	.8547	.8547	.8547	.8547	.8547			
B4	.4979	.4979	.4979	.4979	.4979	.4979	.4979	.4979	.4979			
B5	-1.1940	-1.1940	-1.1940	-1.1940	-1.1940	-1.1940	-1.1940	-1.1939	-1.1940			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA1 = 300335		QTA2 = 251370		QTA3 = 216400			
AZIMUTH AND TILT COEF.												
C1 = .0626			C2 = -.3630			C3 = -.2343		C4 = 1.4800		C5 = -1.2803		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	21	23	30	39	50	58	67	64	54	46	34	28
QHOR:	384	654	1115	1437	1776	2009	2308	1877	1364	929	508	371

MILES CITY, MONTANA				ELEVATION = 2635				LAT = 46.4				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	42.82	28.32	23.82	20.51	18.00	16.03	14.46	13.16	11.16			
VT2/DD	36.74	24.30	20.44	17.60	15.44	13.76	12.40	11.29	9.58			
VT3/DD	31.94	21.12	17.77	15.30	13.42	11.96	10.78	9.82	8.32			
MONTHLY DD	532	804	956	1110	1265	1420	1575	1730	2040			
ANNUAL DD	1529	2800	3655	4630	5717	6923	8259	9715	12940			
PARAMETER A	.654	.693	.700	.705	.712	.721	.733	.745	.754			
AZIMUTH AND TILT COEF.												
A1	.0869	.0855	.0856	.0852	.0842	.0822	.0795	.0769	.0736			
A2	.2404	.3230	.3783	.4326	.4853	.5354	.5835	.6326	.7472			
A3	-.2071	-.3062	-.3686	-.4309	-.4928	-.5539	-.6152	-.6801	-.8349			
A4	.1178	.1776	.2155	.2534	.2912	.3287	.3663	.4060	.5004			
A5	.0421	.0391	.0397	.0393	.0379	.0344	.0289	.0210	-.0009			
B1	-.0065	-.0065	-.0065	-.0065	-.0065	-.0065	-.0065	-.0065	-.0065			
B2	-1.2335	-1.2335	-1.2335	-1.2335	-1.2335	-1.2335	-1.2335	-1.2335	-1.2335			
B3	.8646	.8646	.8647	.8646	.8646	.8647	.8646	.8646	.8646			
B4	.5060	.5060	.5060	.5060	.5060	.5060	.5060	.5060	.5060			
B5	-1.2140	-1.2140	-1.2140	-1.2140	-1.2140	-1.2140	-1.2140	-1.2140	-1.2140			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 325433	QTA2 = 272494			QTA3 = 234589					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	14	18	31	42	54	66	76	74	59	48	32	21
QHOR:	460	749	1141	1488	1890	2153	2300	2001	1485	978	573	386

MISSOULA, MONTANA				ELEVATION = 3189				LAT = 46.9				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	48.22	21.16	15.56	12.30	10.17	8.67	7.56	6.70	5.45			
VT2/DD	41.17	18.06	13.28	10.50	8.68	7.40	6.45	5.72	4.66			
VT3/DD	35.74	15.68	11.53	9.12	7.54	6.43	5.60	4.96	4.04			
MONTHLY DD	231	431	586	741	896	1051	1206	1361	1671			
ANNUAL DD	547	1770	2681	3765	5012	6409	7925	9541	12977			
PARAMETER A	.702	.867	.950	1.018	1.076	1.126	1.164	1.191	1.220			
AZIMUTH AND TILT COEF.												
A1	-.0660	.0745	.0662	.0608	.0567	.0536	.0517	.0508	.0507			
A2	.0480	.0944	.1146	.1315	.1458	.1601	.1764	.1951	.2352			
A3	-.0354	-.1155	-.1386	-.1598	-.1795	-.2006	-.2255	-.2540	-.3144			
A4	.0031	.1155	.1287	.1409	.1519	.1639	.1785	.1959	.2337			
A5	.0318	-.0407	-.0398	-.0409	-.0435	-.0476	-.0535	-.0605	-.0759			
B1	.0101	-.0754	-.0754	-.0754	-.0754	-.0754	-.0754	-.0754	-.0754			
B2	-1.0107	-.9996	-.9996	-.9996	-.9996	-.9996	-.9996	-.9996	-.9996			
B3	.7003	.7169	.7168	.7168	.7168	.7168	.7168	.7168	.7168			
B4	.6127	.5644	.5644	.5644	.5644	.5644	.5644	.5644	.5644			
B5	-1.0783	-1.0278	-1.0278	-1.0278	-1.0279	-1.0279	-1.0278	-1.0279	-1.0279			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 255076	QTA2 = 212669			QTA3 = 182836					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	23	31	34	43	52	59	67	65	54	42	34	26
QHOR:	313	586	976	1338	1716	1981	2312	1875	1348	804	389	260

GRAND ISLAND, NEBRASKA				ELEVATION = 1857				LAT = 41.0				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	82.08	48.03	38.94	32.52	27.84	24.32	21.59	19.41	16.15			
VT2/DD	70.31	41.14	33.35	27.86	23.85	20.83	18.49	16.63	13.83			
VT3/DD	61.10	35.75	28.99	24.21	20.73	18.10	16.07	14.45	12.02			
MONTHLY DD	363	620	765	916	1070	1225	1380	1535	1845			
ANNUAL DD	911	1989	2717	3565	4535	5616	6829	8169	11307			
PARAMETER A	.510	.529	.539	.545	.550	.553	.560	.567	.557			
AZIMUTH AND TILT COEF.												
A1	.0586	.0782	.0822	.0847	.0860	.0864	.0853	.0834	.0824			
A2	.1525	.3400	.4106	.4823	.5573	.6353	.7156	.8055	1.0592			
A3	-.1001	-.2850	-.3616	-.4455	-.5367	-.6337	-.7398	-.8629	-1.2098			
A4	.1324	.2536	.3005	.3504	.4043	.4615	.5224	.5920	.7923			
A5	.0098	.0289	.0320	.0307	.0266	.0206	.0100	-.0050	-.0498			
B1	-.0438	-.0438	-.0438	-.0438	-.0438	-.0438	-.0438	-.0438	-.0438			
B2	-1.1710	-1.1710	-1.1710	-1.1710	-1.1710	-1.1710	-1.1710	-1.1710	-1.1710			
B3	.7477	.7477	.7477	.7477	.7477	.7477	.7477	.7477	.7477			
B4	.6393	.6394	.6394	.6394	.6394	.6394	.6394	.6394	.6393			
B5	-1.2747	-1.2748	-1.2748	-1.2748	-1.2748	-1.2748	-1.2748	-1.2748	-1.2747			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 323891	QTA2 = 270409			QTA3 = 232417					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	20	24	35	48	61	70	76	73	63	53	39	25
QHOR:	654	930	1280	1715	1993	2183	2182	1928	1464	1124	699	564

NORTH PLATTE, NEBRASKA

NORTH PLATTE, NEBRASKA												
ELEVATION = 2785												
LAT = 41.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	85.52	50.72	41.05	34.26	29.35	25.65	22.78	20.48	17.05			
VT2/DD	73.25	43.44	35.16	29.34	25.13	21.97	19.51	17.54	14.60			
VT3/DD	63.65	37.75	30.55	25.50	21.84	19.09	16.95	15.24	12.69			
MONTHLY DD	368	621	767	920	1073	1228	1383	1538	1848			
ANNUAL DD	972	2168	2958	3871	4900	6048	7336	8768	11987			
PARAMETER A	.755	.623	.586	.563	.552	.551	.553	.553	.527			
AZIMUTH AND TILT COEF.												
A1	-.0443	-.0621	-.0669	-.0696	-.0704	-.0696	-.0684	-.0675	-.0695			
A2	.2154	.4131	.5062	.5949	.6757	.7501	.8318	.9299	1.2239			
A3	-.2391	-.4540	-.5579	-.6585	-.7523	-.8439	-.9509	-1.0837	-1.4826			
A4	-.1323	.2612	.3248	.3868	.4451	.5021	.5683	.6496	.8912			
A5	.0187	.0343	.0381	.0400	.0392	.0333	.0208	.0021	-.0515			
B1	.0092	.0092	.0092	.0092	.0092	.0092	.0092	.0092	.0092			
B2	-1.1660	-1.1660	-1.1660	-1.1660	-1.1660	-1.1660	-1.1660	-1.1660	-1.1660			
B3	-.7662	-.7662	-.7662	-.7662	-.7662	-.7662	-.7662	-.7662	-.7662			
B4	-.6449	-.6449	-.6449	-.6449	-.6449	-.6449	-.6449	-.6449	-.6449			
B5	-1.2778	-1.2778	-1.2778	-1.2778	-1.2778	-1.2778	-1.2778	-1.2778	-1.2778			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA2 = 286992		QTA3 = 246740					
AZIMUTH AND TILT COEF. C1 = -.0215 C2 = -.3646 C3 = -.2949 C4 = 1.5991 C5 = -1.3261												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	20	26	32	45	60	67	73	71	58	50	34	26
QHOR:	699	925	1341	1701	2034	2320	2227	1996	1578	1191	768	589

OMAHA, NEBRASKA

OMAHA, NEBRASKA												
ELEVATION = 1325												
LAT = 41.4												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)			
VT1/DD	79.21	47.05	37.96	31.55	26.96	23.54	20.89	18.41	14.87			
VT2/DD	67.79	40.26	32.48	27.00	23.07	20.14	17.87	15.78	12.74			
VT3/DD	58.89	34.98	28.22	23.46	20.05	17.50	15.53	13.71	11.07			
MONTHLY DD	363	611	757	911	1066	1221	1376	1531	1611			
ANNUAL DD	826	1753	2397	3161	4051	5064	6197	7485	10562			
PARAMETER A	.429	.473	.487	.502	.513	.521	.531	.570	.627			
AZIMUTH AND TILT COEF.												
A1	.0643	.0563	.0521	.0471	.0421	.0382	.0349	-.0020	-.0047			
A2	-.1793	-.2584	-.3176	-.3714	-.4246	-.4867	-.5531	-.6243	-.6946			
A3	-.1248	-.2137	-.2742	-.3312	-.3917	-.4672	-.5512	-.6412	-.7350			
A4	-.1530	.2108	.2524	.2911	.3320	.3818	.4351	.5050	.6798			
A5	.0533	.0529	.0574	.0595	.0575	.0513	.0430	.0350	-.0088			
B1	.0109	.0109	.0109	.0109	.0109	.0109	.0109	.0216	.0216			
B2	-1.1209	-1.1210	-1.1209	-1.1209	-1.1209	-1.1209	-1.1209	-1.1916	-1.1916			
B3	.7381	.7381	.7381	.7381	.7381	.7381	.7381	.8302	.8302			
B4	.6413	.6413	.6413	.6413	.6413	.6413	.6413	.5773	.5774			
B5	-1.2523	-1.2523	-1.2523	-1.2523	-1.2523	-1.2523	-1.2523	-1.2247	-1.2247			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA2 = 257857		QTA3 = 221771					
AZIMUTH AND TILT COEF. C1 = .0218 C2 = -.3111 C3 = -.2855 C4 = 1.5735 C5 = -1.2742												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	20	25	39	54	65	72	76	75	63	55	40	28
QHOR:	662	931	1185	1510	2002	2182	2063	1872	1394	1010	683	526

SCOTTSDLUFF, NEBRASKA

SCOTTSDLUFF, NEBRASKA												
ELEVATION = 3957												
LAT = 41.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	105.47	58.51	46.28	37.89	31.94	27.37	23.81	21.07	17.12			
VT2/DD	90.36	50.13	39.65	32.46	27.36	23.49	20.44	18.08	14.70			
VT3/DD	78.53	43.57	34.46	28.21	23.78	20.42	17.77	15.72	12.78			
MONTHLY DD	294	530	670	818	970	1036	1191	1346	1656			
ANNUAL DD	861	2011	2806	3749	4813	6000	7328	8792	12031			
PARAMETER A	.692	.586	.553	.534	.522	.518	.524	.529	.512			
AZIMUTH AND TILT COEF.												
A1	.0125	.0244	.0293	.0333	.0365	.0585	.0596	.0608	.0662			
A2	.1738	.4488	.5752	.6881	.7978	1.2392	1.3198	1.4061	1.6814			
A3	-.2059	-.5034	-.6386	-.7618	-.8897	-1.2464	-1.3600	-1.4853	-1.8607			
A4	.1354	.3226	.4084	.4865	.5665	.8027	.8706	.9456	1.1745			
A5	-.0031	.0100	.0174	.0219	.0192	.0944	.0777	.0560	.0025			
B1	-.0195	-.0195	-.0195	-.0195	-.0195	-.0244	-.0244	-.0244	-.0244			
B2	-1.1751	-1.1751	-1.1751	-1.1751	-1.1751	-1.2556	-1.2556	-1.2556	-1.2556			
B3	.7752	.7752	.7752	.7752	.7752	.8632	.8632	.8632	.8632			
B4	.6209	.6208	.6208	.6208	.6208	.5404	.5404	.5404	.5404			
B5	-1.2768	-1.2768	-1.2768	-1.2768	-1.2767	-1.2634	-1.2633	-1.2634	-1.2634			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA2 = 283282		QTA3 = 243534					
AZIMUTH AND TILT COEF. C1 = .0048 C2 = -.3818 C3 = -.2798 C4 = 1.5940 C5 = -1.3381												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	23	29	34	44	56	66	72	72	59	46	35	26
QHOR:	667	946	1275	1648	1921	2236	2273	2001	1645	1092	714	552

ELKO, NEVADA

ELEVATION = 5075

LAT = 40.8

	TB30 (M=12)	TB40 (M=12)	TB45 (M=12)	TB50 (M=12)	TB55 (M=12)	TB60 (M=12)	TB65 (M=12)	TB70 (M=12)	TB80 (M=12)			
SOUTH-VERT.	113.38	59.25	45.75	37.18	31.31	27.04	23.80	21.25	17.50			
VT1/DD	97.29	50.85	39.26	31.91	26.87	23.21	20.42	18.24	15.02			
VT2/DD	84.58	44.20	34.13	27.74	23.36	20.17	17.75	15.85	13.06			
VT3/DD	271	519	672	827	982	1137	1292	1447	1757			
MONTHLY DD	681	1829	2693	3708	4872	6164	7570	9073	12321			
ANNUAL DD	.766	.794	.786	.773	.758	.738	.715	.687	.623			
PARAMETER A	AZIMUTH AND TILT COEF.											
A1	.0048	.0181	.0254	.0325	.0394	.0459	.0522	.0586	.0717			
A2	.1670	.3734	.4863	.5987	.7167	.8421	.9794	1.1308	1.4783			
A3	-.1284	-.3533	-.4859	-.6218	-.7702	-.9314	-1.1108	-1.3092	-1.7628			
A4	.0900	.2214	.2957	.3717	.4546	.5451	.6463	.7588	1.0180			
A5	.0430	.0506	.0492	.0443	.0343	.0201	.0018	-.0191	-.0660			
B1	-.0166	-.0166	-.0166	-.0166	-.0166	-.0166	-.0166	-.0166	-.0166			
B2	-1.2535	-1.2535	-1.2535	-1.2535	-1.2535	-1.2535	-1.2535	-1.2535	-1.2535			
B3	.8504	.8503	.8504	.8504	.8503	.8503	.8504	.8503	.8503			
B4	.5711	.5711	.5711	.5711	.5711	.5711	.5710	.5711	.5711			
B5	-1.2706	-1.2706	-1.2706	-1.2707	-1.2706	-1.2706	-1.2706	-1.2706	-1.2706			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 376783 QTA2 = 314220 QTA3 = 269870												
AZIMUTH AND TILT COEF. C1 = .0427 C2 = -.2528 C3 = -.4448 C4 = 1.6982 C5 = -1.3871												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	26	31	37	43	54	62	73	67	58	46	35	23
QHOR:	721	1114	1434	1895	2298	2586	2606	2360	1922	1309	800	616

ELY, NEVADA

ELEVATION = 6253

LAT = 39.3

	TB30 (M=1)	TB40 (M=1)	TB45 (M=1)	TB50 (M=1)	TB55 (M=1)	TB60 (M=1)	TB65 (M=1)	TB70 (M=1)	TB80 (M=1)			
SOUTH-VERT.	122.10	64.20	50.45	41.27	34.86	30.16	26.59	23.77	19.61			
VT1/DD	104.52	54.96	43.19	35.33	29.84	25.82	22.76	20.35	16.79			
VT2/DD	90.82	47.76	37.53	30.70	25.93	22.44	19.78	17.68	14.59			
VT3/DD	285	541	689	842	997	1152	1307	1462	1772			
MONTHLY DD	929	2202	3081	4107	5295	6622	8079	9642	13008			
ANNUAL DD	.620	.641	.634	.624	.613	.597	.573	.543	.469			
PARAMETER A	AZIMUTH AND TILT COEF.											
A1	.1402	.1472	.1533	.1592	.1653	.1730	.1838	.1985	.2396			
A2	.2962	.4979	.6177	.7443	.8808	1.0332	1.2121	1.4223	1.9443			
A3	-.3848	-.6266	-.7791	-.9433	-1.1230	-1.3258	-1.5650	-1.8848	-2.5332			
A4	.1473	.2787	.3598	.4483	.5469	.6590	.7916	.9466	1.3273			
A5	-.0173	-.0229	-.0323	-.0452	-.0618	-.0823	-.1069	-.1343	-.1936			
B1	-.0494	-.0494	-.0494	-.0494	-.0494	-.0494	-.0494	-.0494	-.0494			
B2	-1.1627	-1.1627	-1.1627	-1.1627	-1.1627	-1.1627	-1.1627	-1.1627	-1.1627			
B3	.7557	.7557	.7557	.7557	.7557	.7557	.7557	.7557	.7557			
B4	.7022	.7022	.7022	.7022	.7022	.7022	.7022	.7022	.7022			
B5	-1.2929	-1.2928	-1.2928	-1.2928	-1.2928	-1.2928	-1.2929	-1.2928	-1.2928			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 385856 QTA2 = 321819 QTA3 = 276464												
AZIMUTH AND TILT COEF. C1 = .0716 C2 = -.2616 C3 = -.4361 C4 = 1.6828 C5 = -1.3759												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	22	29	34	41	50	58	68	66	58	45	33	24
QHOR:	809	1142	1646	1952	2262	2495	2491	2217	1890	1450	920	722

LAS VEGAS, NEVADA

ELEVATION = 2178

LAT = 36.1

	TB30 (M=2)	TB40 (M=1)	TB45 (M=12)	TB50 (M=12)	TB55 (M=12)	TB60 (M=12)	TB65 (M=12)	TB70 (M=12)	TB80 (M=12)			
SOUTH-VERT.	NA	814.03	333.02	172.77	108.35	76.32	58.40	47.28	34.23			
VT1/DD	NA	696.84	285.47	148.11	92.88	65.42	50.07	40.53	29.35			
VT2/DD	NA	605.63	248.14	128.74	80.73	56.87	43.52	35.23	25.51			
VT3/DD	2	52	116	223	355	504	659	814	1124			
MONTHLY DD	6	131	332	664	1161	1831	2658	3625	5957			
ANNUAL DD	NA	.414	.435	.538	.590	.615	.617	.608	.577			
PARAMETER A	AZIMUTH AND TILT COEF.											
A1	NA	.0064	-.0411	-.0335	-.0317	-.0310	-.0313	-.0319	-.0335			
A2	NA	.1472	.4032	.3518	.4041	.5101	.6462	.7991	1.1315			
A3	NA	-.1577	-.3605	-.3246	-.4031	-.5493	-.7293	-.9290	-1.3692			
A4	NA	.0813	.2596	.2282	.2678	.3457	.4434	.5524	.7929			
A5	NA	.0143	.0350	.0254	.0132	-.0050	-.0228	-.0411	-.0851			
B1	NA	.0127	.0236	.0236	.0236	.0236	.0236	.0236	.0236			
B2	NA	-1.1942	-1.2441	-1.2441	-1.2441	-1.2441	-1.2441	-1.2441	-1.2441			
B3	NA	.7305	.8022	.8022	.8022	.8022	.8022	.8022	.8022			
B4	NA	.7886	.7135	.7136	.7135	.7135	.7135	.7135	.7135			
B5	NA	-1.3450	-1.3197	-1.3197	-1.3197	-1.3197	-1.3197	-1.3197	-1.3197			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 405194 QTA2 = 337375 QTA3 = 289592												
AZIMUTH AND TILT COEF. C1 = .0187 C2 = -.2297 C3 = -.5440 C4 = 1.8642 C5 = -1.4054												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	44	49	57	62	74	84	91	87	80	68	53	43
QHOR:	1005	1398	1893	2389	2653	2781	2550	2366	2066	1519	1092	859

LOVELOCK, NEVADA

		ELEVATION = 3904										LAT = 40.1	
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	199.48	92.24	69.20	54.25	44.09	37.00	31.86	27.95	22.44				
VT2/DD	170.81	78.98	59.26	46.45	37.75	31.68	27.28	23.93	19.22				
VT3/DD	148.44	68.64	51.50	40.37	32.81	27.53	23.71	20.80	16.70				
MONTHLY DD	177	383	510	651	801	954	1108	1263	1573				
ANNUAL DD	463	1322	1986	2818	3811	4953	6232	7627	10722				
PARAMETER A	.616	.677	.681	.668	.653	.638	.623	.603	.550				
AZIMUTH AND TILT COEF.													
A1	.0331	.0517	.0591	.0665	.0730	.0783	.0828	.0873	.0982				
A2	.0159	.1598	.2601	.3833	.5157	.6516	.7922	.9451	1.3164				
A3	-.0556	-.2077	-.3282	-.4809	-.6459	-.8176	-.9995	-1.2012	-1.6963				
A4	.0349	.1352	.2067	.2943	.3875	.4836	.5850	.6975	.9750				
A5	-.0294	-.0277	-.0345	-.0450	-.0560	-.0687	-.0854	-.1069	-.1634				
B1	-.0195	-.0195	-.0195	-.0195	-.0195	-.0195	-.0195	-.0195	-.0195				
B2	-1.1603	-1.1603	-1.1603	-1.1603	-1.1603	-1.1603	-1.1603	-1.1603	-1.1603				
B3	.7307	.7307	.7307	.7307	.7307	.7307	.7307	.7307	.7307				
B4	.6753	.6753	.6753	.6753	.6753	.6753	.6753	.6753	.6753				
B5	-1.2922	-1.2921	-1.2921	-1.2921	-1.2922	-1.2921	-1.2921	-1.2921	-1.2921				
TOTAL ANNUAL TRANSMITTED RADIATION													
DUE SOUTH AND VERTICAL		QTA1 = 405973			QTA2 = 338297			QTA3 = 290416					
AZIMUTH AND TILT COEF.		C1 = .0331			C2 = -.2060			C3 = -.5192			C4 = 1.7491		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC										C5 = -1.4134		
TAVE:	29 35 42 48 58 67 77 73 63 50 39 30												
QHOR:	793 1179 1636 2190 2522 2802 2784 2496 2050 1448 892 705												

RENO, NEVADA

		ELEVATION = 4400										LAT = 39.5	
SOUTH-VERT. (M=12)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	295.82	107.17	75.52	56.83	45.16	37.26	31.69	27.57	21.88				
VT2/DD	253.79	91.94	64.79	48.76	38.74	31.97	27.19	23.65	18.77				
VT3/DD	220.61	79.92	56.32	42.38	33.68	27.79	23.64	20.56	16.32				
MONTHLY DD	111	307	435	578	728	882	1037	1192	1502				
ANNUAL DD	296	1162	1874	2771	3831	5052	6416	7893	11110				
PARAMETER A	.840	.800	.769	.750	.731	.710	.682	.648	.569				
AZIMUTH AND TILT COEF.													
A1	-.0117	-.0201	-.0247	-.0283	-.0315	-.0345	-.0377	-.0412	-.0488				
A2	.2052	.4174	.5525	.6837	.8156	.9559	1.1188	1.3083	1.7640				
A3	-.1839	-.4276	-.5963	-.7643	-.9345	-1.1177	-1.3323	-1.5819	-2.1786				
A4	.1191	.2556	.3493	.4421	.5359	.6372	.7565	.8960	1.2309				
A5	.0260	.0230	.0112	-.0029	-.0176	-.0353	-.0578	-.0846	-.1453				
B1	.0352	.0352	.0352	.0352	.0352	.0352	.0352	.0352	.0352				
B2	-1.2504	-1.2504	-1.2504	-1.2504	-1.2504	-1.2504	-1.2504	-1.2504	-1.2504				
B3	.8360	.8360	.8360	.8360	.8360	.8360	.8360	.8360	.8360				
B4	.6114	.6114	.6114	.6114	.6114	.6114	.6114	.6114	.6114				
B5	-1.2847	-1.2847	-1.2847	-1.2847	-1.2847	-1.2847	-1.2847	-1.2847	-1.2847				
TOTAL ANNUAL TRANSMITTED RADIATION													
DUE SOUTH AND VERTICAL		QTA1 = 396079			QTA2 = 330088			QTA3 = 283405					
AZIMUTH AND TILT COEF.		C1 = .0266			C2 = -.2316			C3 = -.4916			C4 = 1.7538		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC										C5 = -1.4065		
TAVE:	33 36 42 46 54 65 71 68 60 48 38 31												
QHOR:	846 1130 1682 2072 2454 2726 2661 2429 2023 1424 904 679												

TONOPAH, NEVADA

		ELEVATION = 5423										LAT = 38.1	
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	318.84	122.82	90.06	68.73	54.52	45.18	38.57	33.65	26.81				
VT2/DD	273.21	105.24	77.18	58.98	46.79	38.77	33.10	28.88	23.01				
VT3/DD	237.49	91.48	67.09	51.28	40.68	33.71	28.78	25.11	20.00				
MONTHLY DD	140	362	494	595	750	905	1060	1215	1525				
ANNUAL DD	323	1166	1836	2664	3649	4783	6060	7472	10631				
PARAMETER A	.599	.642	.595	.570	.558	.539	.519	.496	.426				
AZIMUTH AND TILT COEF.													
A1	.0584	.0625	.0713	-.0636	-.0627	-.0626	-.0626	-.0629	-.0669				
A2	.0648	.3606	.5445	.9512	1.1124	1.2921	1.4870	1.7146	2.3749				
A3	-.1214	-.4375	-.6393	-1.0466	-1.2416	-1.4628	-1.7090	-2.0051	-2.8665				
A4	.0605	.2404	.3543	.5932	.7019	.8246	.9608	1.1242	1.6005				
A5	-.0242	-.0072	.0015	.0147	.0067	-.0049	-.0222	-.0494	-.1296				
B1	-.0113	-.0113	-.0113	-.0370	.0370	.0370	.0370	.0370	.0370				
B2	-1.2091	-1.2091	-1.2091	-1.2718	-1.2718	-1.2718	-1.2718	-1.2718	-1.2718				
B3	.7440	.7440	.7440	.8288	.8288	.8288	.8288	.8288	.8288				
B4	.7115	.7115	.7115	.6380	.6380	.6380	.6380	.6380	.6380				
B5	-1.3533	-1.3534	-1.3533	-1.3250	-1.3251	-1.3251	-1.3251	-1.3251	-1.3251				
TOTAL ANNUAL TRANSMITTED RADIATION													
DUE SOUTH AND VERTICAL		QTA1 = 422366			QTA2 = 352173			QTA3 = 302419					
AZIMUTH AND TILT COEF.		C1 = .0414			C2 = -.2475			C3 = -.4996			C4 = 1.7671		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC										C5 = -1.4292		
TAVE:	29 37 42 47 57 68 74 72 63 50 40 30												
QHOR:	948 1274 1738 2277 2620 2746 2678 2428 2056 1545 1065 818												

WINNEMUCCA, NEVADA												
ELEVATION = 4341												
LAT = 40.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	220.03	85.28	61.24	46.97	37.97	31.84	27.42	24.07	19.35			
VT2/DD	188.49	73.05	52.46	40.24	32.52	27.28	23.49	20.62	16.58			
VT3/DD	163.81	63.49	45.59	34.97	28.27	23.71	20.41	17.92	14.40			
MONTHLY DD	139	359	499	651	805	960	1115	1270	1580			
ANNUAL DD	467	1466	2228	3154	4236	5464	6811	8258	11416			
PARAMETER A	.638	.701	.704	.704	.699	.689	.672	.650	.598			
AZIMUTH AND TILT COEF.												
A1	.0408	.0390	.0414	.0428	.0445	.0464	.0486	.0511	.0569			
A2	.1549	.3634	.4672	.5510	.6403	.7437	.8631	.9955	1.3062			
A3	-.2295	-.4604	-.5770	-.6731	-.7823	-.9148	-1.0719	-1.2484	-1.6643			
A4	.1148	.2472	.3134	.3686	.4306	.5054	.5939	.6934	.9287			
A5	-.0472	-.0405	-.0382	-.0387	-.0449	-.0571	-.0744	-.0956	-.1465			
B1	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002			
B2	-1.1834	-1.1834	-1.1834	-1.1834	-1.1834	-1.1834	-1.1834	-1.1834	-1.1834			
B3	.7689	.7689	.7689	.7689	.7689	.7689	.7689	.7689	.7689			
B4	.6520	.6520	.6520	.6520	.6520	.6520	.6520	.6520	.6520			
B5	-1.2657	-1.2657	-1.2657	-1.2657	-1.2657	-1.2657	-1.2657	-1.2657	-1.2657			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 380423			QTA2 = 317174			QTA3 = 272363					
AZIMUTH AND TILT COEF.	C1 = .0428	C2 = -.2466	C3 = -.4591	C4 = 1.7064	C5 = -1.3864							
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	29	35	38	43	56	66	74	70	60	48	39	28
QHQR:	690	1060	1473	1996	2339	2677	2631	2342	1941	1319	814	656

YUCCA FLATS, NEVADA												
ELEVATION = 3927												
LAT = 36.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	394.34	134.40	93.26	69.49	54.39	44.44	37.54	32.49	25.60			
VT2/DD	338.15	115.25	79.97	59.59	46.64	38.11	32.19	27.86	21.95			
VT3/DD	293.94	100.18	69.51	51.80	40.55	33.13	27.98	24.22	19.08			
MONTHLY DD	95	279	402	539	688	843	998	1153	1463			
ANNUAL DD	252	906	1452	2152	3018	4043	5202	6486	9384			
PARAMETER A	.770	.754	.744	.734	.714	.689	.661	.629	.554			
AZIMUTH AND TILT COEF.												
A1	.0115	.0188	.0135	.0155	.0178	.0202	.0227	.0251	.0302			
A2	.4298	.4691	.5471	.6453	.7605	.8926	1.0408	1.2107	1.6516			
A3	-.4597	-.4985	-.5984	-.7255	-.8746	-1.0468	-1.2410	-1.4652	-2.0531			
A4	.2644	.2892	.3428	.4103	.4897	.5817	.6859	.8067	1.1246			
A5	.0197	.0215	.0138	.0038	-.0079	-.0224	-.0394	-.0605	-.1200			
B1	.0104	.0104	.0104	.0104	.0104	.0104	.0104	.0104	.0104			
B2	-1.2526	-1.2526	-1.2525	-1.2526	-1.2526	-1.2525	-1.2526	-1.2525	-1.2525			
B3	.8197	.8197	.8197	.8197	.8197	.8197	.8197	.8197	.8197			
B4	.6872	.6872	.6872	.6872	.6872	.6872	.6872	.6872	.6872			
B5	-1.3154	-1.3154	-1.3154	-1.3154	-1.3154	-1.3154	-1.3154	-1.3154	-1.3154			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 400968			QTA2 = 333927			QTA3 = 286642					
AZIMUTH AND TILT COEF.	C1 = .0306	C2 = -.2115	C3 = -.5494	C4 = 1.8360	C5 = -1.4082							
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	36	38	43	52	61	73	79	76	68	55	45	32
QHQR:	945	1291	1773	2161	2559	2771	2705	2382	2085	1563	1028	815

CONCORD, NEW HAMPSHIRE												
ELEVATION = 344												
LAT = 43.2												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	45.43	23.55	18.45	15.10	12.76	11.03	9.71	8.67	7.14			
VT2/DD	38.84	20.13	15.78	12.91	10.91	9.43	8.30	7.41	6.10			
VT3/DD	33.73	17.49	13.70	11.21	9.48	8.19	7.21	6.44	5.30			
MONTHLY DD	276	532	680	830	983	1137	1292	1447	1757			
ANNUAL DD	962	2149	2960	3909	4991	6213	7582	9092	12439			
PARAMETER A	.585	.743	.806	.855	.893	.929	.960	.986	1.009			
AZIMUTH AND TILT COEF.												
A1	-.0436	-.0242	-.0188	-.0150	-.0121	-.0098	-.0080	-.0065	-.0041			
A2	.2490	.2742	.2819	.2941	.3110	.3278	.3476	.3724	.4442			
A3	-.3041	-.3251	-.3319	-.3468	-.3689	-.3921	-.4199	-.4555	-.5575			
A4	.2295	.2347	.2385	.2481	.2622	.2764	.2933	.3144	.3750			
A5	-.0630	-.0456	-.0421	-.0422	-.0443	-.0474	-.0516	-.0573	-.0737			
B1	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001			
B2	-1.0874	-1.0874	-1.0874	-1.0874	-1.0874	-1.0874	-1.0874	-1.0874	-1.0874			
B3	.7676	.7676	.7676	.7676	.7676	.7676	.7676	.7676	.7676			
B4	.6042	.6042	.6042	.6042	.6042	.6042	.6042	.6042	.6042			
B5	-1.1053	-1.1053	-1.1053	-1.1053	-1.1054	-1.1053	-1.1053	-1.1053	-1.1053			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 233141			QTA2 = 194711			QTA3 = 167543					
AZIMUTH AND TILT COEF.	C1 = .0206	C2 = -.3168	C3 = -.2224	C4 = 1.5143	C5 = -1.1470							
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	20	24	31	45	57	65	70	67	58	49	38	23
QHQR:	453	715	966	1296	1648	1749	1649	1423	1074	816	465	336

LAKEHURST, NEW JERSEY

		ELEVATION = 121				LAT = 40.0				
SOUTH-VERT. (M=1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	
VT1/DD	151.55	62.03	44.41	34.19	27.55	21.89	18.10	15.42	11.89	
VT2/DD	129.48	53.00	37.94	29.21	23.54	18.70	15.47	13.17	10.16	
VT3/DD	112.45	46.03	32.95	25.37	20.44	16.24	13.43	11.44	8.82	
MONTHLY DD	144	353	493	640	585	736	890	1045	1355	
ANNUAL DD	303	986	1584	2334	3232	4285	5497	6857	10033	
PARAMETER A	.510	.585	.582	.570	.575	.648	.702	.746	.796	
AZIMUTH AND TILT COEF.										
A1	.0432	.0540	.0622	.0684	-.0737	-.0615	-.0538	-.0487	-.0435	
A2	.3238	.3713	.4543	.5459	.6152	.6005	.6056	.6186	.6920	
A3	-.2895	-.3544	-.4459	-.5542	-.7143	-.7082	-.7245	-.7502	-.8641	
A4	.1424	.1840	.2419	.3095	.4892	.4806	.4880	.5013	.5648	
A5	.0930	.0862	.0898	.0872	-.0627	-.0655	-.0704	-.0762	-.0952	
B1	-.0188	-.0188	-.0188	-.0188	.0351	.0351	.0351	.0351	.0351	
B2	-1.0806	-1.0806	-1.0806	-1.0806	-1.0743	-1.0743	-1.0743	-1.0743	-1.0743	
B3	.7081	.7081	.7081	.7081	.7382	.7382	.7382	.7382	.7382	
B4	.7254	.7254	.7254	.7254	.6712	.6711	.6711	.6711	.6711	
B5	-1.1975	-1.1975	-1.1975	-1.1975	-1.1328	-1.1327	-1.1327	-1.1327	-1.1327	
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 259427			QTA2 = 216569			QTA3 = 186313		
AZIMUTH AND TILT COEF.		C1 = .0138			C2 = -.3217			C3 = -.2356		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC									
TAVE:	29 32 40 49 59 70 74 72 65 56 46 36									
QHOR:	594 810 1141 1458 1777 1776 1752 1593 1261 963 661 447									

NEWARK, NEW JERSEY

		ELEVATION = 30				LAT = 40.7				
SOUTH-VERT. (M=1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	
VT1/DD	208.63	69.18	47.38	35.34	28.02	23.18	19.74	17.19	13.45	
VT2/DD	178.35	59.14	40.50	30.21	23.96	19.82	16.87	14.69	11.50	
VT3/DD	154.90	51.37	35.17	26.24	20.81	17.21	14.66	12.76	9.99	
MONTHLY DD	99	298	434	583	735	888	1043	1198	1378	
ANNUAL DD	185	823	1400	2125	2982	3972	5105	6421	9575	
PARAMETER A	.530	.524	.531	.533	.536	.549	.566	.591	.646	
AZIMUTH AND TILT COEF.										
A1	-.0079	-.0118	-.0182	-.0234	-.0261	-.0273	-.0283	-.0290	-.0388	
A2	.2488	.3268	.4292	.5210	.5951	.6591	.7178	.7635	.9535	
A3	-.2489	-.3507	-.4647	-.5636	-.6499	-.7331	-.8141	-.8816	-1.1022	
A4	.1368	.1812	.2435	.2991	.3488	.3981	.4476	.4902	.6803	
A5	.0379	.0439	.0552	.0667	.0691	.0621	.0505	.0365	-.0234	
B1	.0206	.0206	.0206	.0206	.0206	.0206	.0206	.0206	.0240	
B2	-1.1013	-1.1013	-1.1013	-1.1012	-1.1013	-1.1013	-1.1012	-1.1013	-1.1312	
B3	.7459	.7459	.7459	.7458	.7459	.7459	.7459	.7459	.7818	
B4	.6977	.6976	.6977	.6977	.6976	.6976	.6976	.6977	.6413	
B5	-1.1892	-1.1892	-1.1892	-1.1893	-1.1892	-1.1892	-1.1892	-1.1892	-1.1664	
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 257955			QTA2 = 215193			QTA3 = 185041		
AZIMUTH AND TILT COEF.		C1 = -.0029			C2 = -.3094			C3 = -.2657		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC									
TAVE:	31 33 40 52 62 72 75 73 67 57 46 35									
QHOR:	549 794 1143 1461 1799 1825 1769 1559 1299 949 577 476									

ALBUQUERQUE, NEW MEXICO

		ELEVATION = 5312				LAT = 35.1				
SOUTH-VERT. (M=12)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	
VT1/DD	727.92	187.50	116.19	81.13	61.62	49.55	41.42	35.58	27.75	
VT2/DD	623.13	160.23	99.29	69.33	52.66	42.34	35.39	30.40	23.71	
VT3/DD	541.54	139.20	86.26	60.23	45.75	36.79	30.75	26.41	20.60	
MONTHLY DD	59	209	337	482	635	789	944	1099	1409	
ANNUAL DD	179	753	1257	1925	2734	3677	4784	6074	9108	
PARAMETER A	.420	.416	.468	.501	.508	.503	.501	.503	.469	
AZIMUTH AND TILT COEF.										
A1	-.0543	.0095	.0075	.0059	.0050	.0044	.0044	.0052	.0102	
A2	.8541	.5942	.5490	.5665	.6496	.7647	.8901	1.0279	1.4787	
A3	-.8331	-.7137	-.6598	-.6871	-.8005	-.9548	-1.1269	-1.3218	-1.9594	
A4	.6177	.3785	.3554	.3782	.4494	.5440	.6478	.7629	1.1316	
A5	.1115	-.0165	-.0168	-.0249	-.0413	-.0606	-.0841	-.1138	-.2090	
B1	.0342	.0189	.0189	.0189	.0189	.0189	.0189	.0189	.0189	
B2	-1.1094	-1.1094	-1.1095	-1.1094	-1.1094	-1.1095	-1.1094	-1.1094	-1.1094	
B3	.6633	.6633	.6633	.6633	.6633	.6633	.6633	.6633	.6633	
B4	.8164	.8164	.8164	.8164	.8164	.8164	.8164	.8164	.8164	
B5	-1.3401	-1.3401	-1.3401	-1.3401	-1.3401	-1.3401	-1.3401	-1.3401	-1.3402	
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 394526			QTA2 = 328454			QTA3 = 281992		
AZIMUTH AND TILT COEF.		C1 = .0531			C2 = -.2322			C3 = -.5058		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC									
TAVE:	34 38 44 54 65 73 77 75 67 57 43 35									
QHOR:	979 1345 1744 2289 2583 2653 2485 2308 1955 1596 1170 950									

CLAYTON, NEW MEXICO												
ELEVATION = 4970												
LAT = 36.4												
	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT.	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	330.72	143.08	102.34	77.07	60.82	49.80	41.99	36.29	28.53			
VT2/DD	283.39	122.60	87.70	66.04	52.12	42.67	35.98	31.09	24.45			
VT3/DD	246.34	106.57	76.23	57.40	45.30	37.09	31.28	27.03	21.25			
MONTHLY DD	125	289	404	537	680	831	985	1140	1450			
ANNUAL DD	362	1023	1561	2241	3062	4036	5191	6533	9701			
PARAMETER A	.502	.448	.445	.437	.430	.423	.419	.412	.351			
AZIMUTH AND TILT COEF.												
A1	.0099	.0164	.0198	.0245	.0293	.0336	.0376	.0412	.0565			
A2	.8240	.9644	1.0279	1.1186	1.2347	1.3808	1.5654	1.7784	2.5891			
A3	-.8385	-.9693	-1.0465	-1.1591	-1.3077	-1.5051	-1.7574	-2.0469	-3.1125			
A4	.4919	.5733	.6205	.6891	.7783	.8941	1.0406	1.2088	1.8326			
A5	.0886	.1101	.1061	.0988	.0866	.0644	.0359	.0049	-.0893			
B1	-.0035	-.0035	-.0035	-.0035	-.0035	-.0035	-.0035	-.0035	-.0035			
B2	-1.1936	-1.1936	-1.1936	-1.1936	-1.1936	-1.1936	-1.1936	-1.1936	-1.1936			
B3	.7618	.7618	.7618	.7618	.7618	.7618	.7618	.7618	.7618			
B4	.6747	.6747	.6747	.6747	.6747	.6747	.6747	.6747	.6747			
B5	-1.3429	-1.3429	-1.3429	-1.3429	-1.3429	-1.3429	-1.3429	-1.3429	-1.3429			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 387230 QTA2 = 323041 QTA3 = 277587												
AZIMUTH AND TILT COEF. C1 = .0338 C2 = -.2928 C3 = -.4199 C4 = 1.7181 C5 = -1.3864												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	33	36	42	53	61	70	74	73	65	55	42	33
QHOR:	972	1243	1725	2076	2264	2296	2323	2107	1779	1485	1037	861

LOS ALAMOS, NEW MEXICO												
ELEVATION = 7380												
LAT = 35.8												
	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT.	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	217.86	93.09	69.00	54.45	44.93	38.27	32.67	28.49	22.27			
VT2/DD	186.62	79.74	59.11	46.64	38.48	32.71	27.92	24.35	18.99			
VT3/DD	162.19	69.31	51.37	40.54	33.45	28.42	24.26	21.16	16.49			
MONTHLY DD	183	428	577	731	886	903	1058	1213	1246			
ANNUAL DD	363	1241	1937	2790	3789	4953	6297	7809	11184			
PARAMETER A	.595	.526	.481	.438	.407	.385	.393	.386	.349			
AZIMUTH AND TILT COEF.												
A1	-.0415	-.0337	-.0231	-.0133	-.0049	.2371	.2347	.2424	-.3778			
A2	.3259	.5814	.7956	1.0708	1.3697	1.2926	1.4863	1.7509	1.8983			
A3	-.2670	-.5250	-.7774	-1.1163	-1.4931	-1.7108	-1.9614	-2.3143	-2.6190			
A4	.1853	.3447	.4905	.6842	.8977	.8886	1.0325	1.2313	1.5627			
A5	.0768	.1021	.0986	.0832	.0613	-.1187	-.1377	-.1713	-.3484			
B1	.0383	.0383	.0383	.0383	.0383	-.0199	-.0199	-.0199	-.1488			
B2	-1.1982	-1.1982	-1.1982	-1.1982	-1.1982	-1.1242	-1.1242	-1.1242	-1.0068			
B3	.7586	.7586	.7586	.7586	.7587	.6897	.6897	.6897	.5457			
B4	.7138	.7138	.7138	.7138	.7138	.8073	.8073	.8074	.8743			
B5	-1.3178	-1.3177	-1.3178	-1.3177	-1.3177	-1.3081	-1.3081	-1.3081	-1.3118			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 342227 QTA2 = 284968 QTA3 = 244705												
AZIMUTH AND TILT COEF. C1 = .1024 C2 = -.2314 C3 = -.4776 C4 = 1.7964 C5 = -1.3387												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	30	32	41	49	54	67	71	65	60	53	38	26
QHOR:	889	1191	1558	2141	2150	2272	2080	1974	1777	1410	796	898

ROSWELL, NEW MEXICO												
ELEVATION = 3619												
LAT = 33.4												
	T830	T840	T845	T850	T855	T860	T865	T870	T880			
SOUTH-VERT.	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	853.90	217.54	138.53	97.57	73.62	58.25	47.75	40.29	30.61			
VT2/DD	730.88	186.20	118.57	83.52	63.02	49.85	40.87	34.48	26.20			
VT3/DD	635.21	161.83	103.05	72.58	54.77	43.33	35.52	29.97	22.77			
MONTHLY DD	46	182	285	405	536	678	827	980	1290			
ANNUAL DD	110	553	949	1488	2171	2990	3960	5101	7865			
PARAMETER A	.660	.584	.582	.584	.573	.552	.533	.518	.464			
AZIMUTH AND TILT COEF.												
A1	.0223	.0347	.0365	.0385	.0425	.0477	.0523	.0560	.0663			
A2	.3584	.5374	.5845	.6631	.7804	.9270	1.0816	1.2475	1.7588			
A3	-.3716	-.5743	-.6321	-.7367	-.8905	-1.0807	-1.2853	-1.5113	-2.2201			
A4	.2402	.3658	.4005	.4598	.5466	.6535	.7674	.8923	1.2859			
A5	.0160	.0139	.0101	-.0009	-.0148	-.0297	-.0479	-.0722	-.1588			
B1	-.0306	-.0306	-.0306	-.0306	-.0306	-.0306	-.0306	-.0306	-.0306			
B2	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869	-1.1869			
B3	.7315	.7315	.7315	.7315	.7315	.7315	.7315	.7315	.7315			
B4	.7936	.7936	.7936	.7936	.7935	.7936	.7936	.7935	.7935			
B5	-1.3433	-1.3433	-1.3433	-1.3433	-1.3433	-1.3433	-1.3433	-1.3433	-1.3433			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 312331 QTA2 = 309904 QTA3 = 266109												
AZIMUTH AND TILT COEF. C1 = .0005 C2 = -.2095 C3 = -.5640 C4 = 1.9251 C5 = -1.3598												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	39	43	51	59	69	77	78	79	69	59	49	38
QHOR:	1058	1382	1834	2219	2449	2586	2490	2195	1921	1479	1160	947

TRUTH OR CONSEQUENCES, NEW MEXICO

		ELEVATION = 4859								LAT = 33.2		
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
VT1/DD	491.46	200.02	133.58	95.63	72.38	57.41	47.30	40.16	30.84			
VT2/DD	419.74	170.83	114.09	81.68	61.81	49.03	40.39	34.30	26.34			
VT3/DD	364.69	148.43	99.12	70.96	53.71	42.60	35.10	29.80	22.89			
MONTHLY DD	84	206	309	431	570	718	872	1026	1336			
ANNUAL DD	124	511	883	1394	2062	2888	3878	5050	7916			
PARAMETER A	.658	.727	.700	.674	.650	.618	.584	.562	.500			
AZIMUTH AND TILT COEF.												
A1	.0005	.0138	.0189	.0232	.0269	.0309	.0349	.0381	.0487			
A2	-.0283	.0878	.1513	.2182	.3115	.4431	.6087	.7855	1.2873			
A3	.0128	-.1421	-.2180	-.3000	-.4203	-.5950	-.8174	-1.0586	-1.7668			
A4	-.0041	.1009	.1500	.2013	.2730	.3750	.5028	.6387	1.0401			
A5	-.0151	-.0354	-.0389	-.0442	-.0559	-.0753	-.1004	-.1285	-.2289			
B1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000			
B2	-1.1041	-1.1042	-1.1042	-1.1042	-1.1042	-1.1041	-1.1041	-1.1042	-1.1042			
B3	.6229	.6229	.6230	.6229	.6229	.6229	.6229	.6229	.6229			
B4	.8873	.8873	.8873	.8873	.8873	.8873	.8873	.8873	.8873			
B5	-1.3745	-1.3745	-1.3745	-1.3745	-1.3745	-1.3745	-1.3745	-1.3745	-1.3745			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 386862 QTA2 = 321982 QTA3 = 276433												
AZIMUTH AND TILT COEF. C1 = .0565 C2 = -.2267 C3 = -.5685 C4 = 1.9430 C5 = -1.3932												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	36	43	50	60	67	77	78	75	72	58	48	39
QHOR:	1066	1429	1850	2347	2570	2684	2382	2227	1965	1522	1256	1029

TUCUMCARI, NEW MEXICO

		ELEVATION = 4039								LAT = 35.2		
SOUTH-VERT. (M= 2)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
VT1/DD	707.95	220.65	141.31	99.78	75.18	59.50	48.90	41.45	31.99			
VT2/DD	600.17	187.07	120.76	85.26	64.24	50.84	41.79	35.42	27.12			
VT3/DD	520.35	162.19	104.92	74.08	55.82	44.17	36.31	30.77	23.51			
MONTHLY DD	50	161	298	421	559	707	860	1015	1111			
ANNUAL DD	177	693	1146	1735	2466	3339	4366	5573	8502			
PARAMETER A	.216	.293	.346	.372	.383	.384	.386	.386	.347			
AZIMUTH AND TILT COEF.												
A1	-.0964	-.0754	.0042	-.0002	-.0034	-.0058	-.0076	-.0091	-.0799			
A2	-1.5724	-.8493	.6704	.7248	.8210	.9526	1.1111	1.2913	.7580			
A3	1.3452	.6698	-.7790	-.8549	-.9845	-1.1603	-1.3757	-1.6223	-1.3021			
A4	-.9882	-.5291	.5337	.5753	.6511	.7549	.8810	1.0251	.6889			
A5	-.4003	-.2658	.0042	-.0088	-.0252	-.0450	-.0709	-.1007	-.3466			
B1	.0317	.0317	.0121	.0121	.0121	.0121	.0121	.0121	.0317			
B2	-.8596	-.8596	-1.0963	-1.0963	-1.0963	-1.0963	-1.0963	-1.0963	-1.0963			
B3	.2951	.2951	.6389	.6389	.6389	.6389	.6389	.6389	.2951			
B4	1.1321	1.1322	.8093	.8093	.8093	.8093	.8093	.8093	1.1322			
B5	-1.4105	-1.4106	-1.3679	-1.3679	-1.3679	-1.3679	-1.3679	-1.3679	-1.4106			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 382497 QTA2 = 318684 QTA3 = 273696												
AZIMUTH AND TILT COEF. C1 = .0099 C2 = -.2789 C3 = -.4751 C4 = 1.8214 C5 = -1.3923												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	37	40	46	56	65	75	78	77	69	59	46	37
QHOR:	1011	1267	1742	2187	2265	2460	2383	2186	1893	1449	1072	930

ALBANY, NEW YORK

		ELEVATION = 292								LAT = 42.8		
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
VT1/DD	68.56	36.44	28.73	23.48	19.07	16.05	13.86	12.19	9.83			
VT2/DD	58.71	31.19	24.60	20.09	16.32	13.73	11.86	10.43	8.41			
VT3/DD	51.01	27.10	21.37	17.45	14.17	11.93	10.30	9.06	7.31			
MONTHLY DD	307	578	733	824	824	979	1134	1289	1599			
ANNUAL DD	773	1868	2645	3528	4519	5633	6886	8305	11586			
PARAMETER A	.549	.557	.544	.555	.620	.674	.724	.770	.829			
AZIMUTH AND TILT COEF.												
A1	.0058	.0147	.0193	-.0019	.0009	.0028	.0040	.0048	.0056			
A2	.4414	.5550	.6486	.5903	.5785	.5769	.5787	.5879	.6517			
A3	-.3952	-.5196	-.6227	-.6560	-.6525	-.6608	-.6737	-.6972	-.8025			
A4	.2144	.2654	.3167	.4550	.4393	.4348	.4356	.4445	.5016			
A5	.1089	.1320	.1432	-.0431	-.0402	-.0408	-.0444	-.0514	-.0745			
B1	.0061	.0061	.0061	.0143	.0143	.0143	.0143	.0143	.0143			
B2	-1.1572	-1.1572	-1.1572	-1.1203	-1.1203	-1.1203	-1.1203	-1.1203	-1.1203			
B3	.7982	.7983	.7982	.7906	.7906	.7906	.7906	.7906	.7906			
B4	.6327	.6327	.6327	.5976	.5976	.5976	.5976	.5976	.5976			
B5	-1.2069	-1.2069	-1.2070	-1.1403	-1.1403	-1.1403	-1.1403	-1.1403	-1.1403			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 264255 QTA2 = 220452 QTA3 = 189523												
AZIMUTH AND TILT COEF. C1 = .0310 C2 = -.2823 C3 = -.2990 C4 = 1.5752 C5 = -1.2016												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	21	23	33	47	56	68	72	69	63	55	39	28
QHOR:	508	789	1076	1484	1870	1938	1926	1687	1223	902	519	400

BINGHAMTON, NEW YORK												
ELEVATION = 1637												
LAT = 42.2												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	36.23	18.47	14.17	11.43	9.54	8.14	7.07	6.25	5.08			
VT2/DD	30.86	15.72	12.06	9.73	8.12	6.93	6.02	5.32	4.32			
VT3/DD	26.79	13.63	10.46	8.44	7.04	6.01	5.22	4.62	3.75			
MONTHLY DD	335	453	590	731	876	1027	1182	1337	1647			
ANNUAL DD	923	2172	3011	3950	5008	6199	7549	9071	12503			
PARAMETER A	.545	.679	.754	.808	.861	.917	.974	1.028	1.104			
AZIMUTH AND TILT COEF.												
A1	-.0506	-.1120	-.1029	-.0970	-.0913	-.0852	-.0791	-.0736	-.0666			
A2	.2675	.1921	.1980	.2039	.2079	.2098	.2123	.2178	.2459			
A3	-.2587	-.2770	-.2764	-.2797	-.2828	-.2844	-.2881	-.2968	-.3400			
A4	.1629	.2473	.2428	.2424	.2413	.2386	.2369	.2386	.2602			
A5	.0402	-.1279	-.1140	-.1064	-.1007	-.0957	-.0922	-.0907	-.0960			
B1	.0555	.0859	.0859	.0859	.0859	.0859	.0859	.0859	.0859			
B2	-.9215	-.8787	-.8787	-.8787	-.8787	-.8787	-.8787	-.8787	-.8787			
B3	.6072	.6048	.6048	.6048	.6048	.6048	.6048	.6048	.6048			
B4	.7162	.6892	.6891	.6891	.6891	.6891	.6891	.6891	.6891			
B5	-1.0690	-.9882	-.9882	-.9882	-.9882	-.9882	-.9882	-.9882	-.9882			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 203903			QTA2 = 169748			QTA3 = 145904			
AZIMUTH AND TILT COEF.			C1 = .0254			C2 = -.1900			C3 = -.3300			
C4 = 1.5741			C5 = -1.0651									
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	20	22	28	43	56	65	69	66	60	50	37	26
QHOR:	382	594	870	1261	1489	1673	1650	1449	1149	725	413	280

BUFFALO, NEW YORK												
ELEVATION = 705												
LAT = 42.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	44.73	22.08	16.44	12.59	10.16	8.49	7.29	6.38	5.11			
VT2/DD	38.07	18.80	14.00	10.72	8.65	7.23	6.20	5.43	4.35			
VT3/DD	33.03	16.31	12.14	9.30	7.50	6.27	5.38	4.71	3.77			
MONTHLY DD	229	463	484	631	783	936	1091	1246	1556			
ANNUAL DD	661	1684	2433	3321	4346	5515	6830	8306	11679			
PARAMETER A	.540	.586	.642	.732	.807	.874	.934	.989	1.074			
AZIMUTH AND TILT COEF.												
A1	-.0296	-.0573	.0402	.0309	.0252	.0210	.0176	.0149	.0109			
A2	.3405	.3639	.3476	.3116	.2896	.2769	.2708	.2692	.2806			
A3	-.3521	-.3920	-.4017	-.3648	-.3442	-.3348	-.3336	-.3380	-.3655			
A4	.1755	.2162	.2710	.2481	.2357	.2306	.2306	.2339	.2523			
A5	.0601	.0398	-.0272	-.0296	-.0332	-.0378	-.0433	-.0492	-.0634			
B1	.0706	.0706	.0259	.0259	.0259	.0259	.0259	.0259	.0259			
B2	-.8883	-.8883	-.8881	-.8881	-.8881	-.8881	-.8881	-.8881	-.8881			
B3	.6106	.6106	.6253	.6253	.6253	.6253	.6253	.6253	.6253			
B4	.7130	.7130	.6852	.6852	.6852	.6851	.6851	.6851	.6851			
B5	-1.0120	-1.0120	-.9822	-.9822	-.9822	-.9822	-.9822	-.9822	-.9822			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 203843			QTA2 = 169379			QTA3 = 145445			
AZIMUTH AND TILT COEF.			C1 = .0116			C2 = -.1584			C3 = -.3865			
C4 = 1.6530			C5 = -1.0812									
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	25	25	33	46	54	66	71	68	61	51	40	29
QHOR:	341	527	891	1281	1681	1799	1769	1485	1180	724	350	267

MASSENA, NEW YORK												
ELEVATION = 207												
LAT = 44.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)			
VT1/DD	32.49	20.29	16.95	14.55	12.75	11.34	10.11	9.05	7.50			
VT2/DD	27.79	17.35	14.50	12.44	10.90	9.70	8.65	7.75	6.42			
VT3/DD	24.14	15.07	12.59	10.81	9.47	8.42	7.51	6.73	5.57			
MONTHLY DD	448	781	935	1089	1244	1398	1336	1491	1801			
ANNUAL DD	1395	2746	3631	4640	5772	7030	8436	9985	13397			
PARAMETER A	.708	.707	.721	.741	.763	.787	.823	.865	.916			
AZIMUTH AND TILT COEF.												
A1	.0875	.0898	.0877	.0843	.0805	.0764	-.1015	-.0950	-.0882			
A2	.1781	.2674	.2978	.3236	.3491	.3750	.4976	.5051	.5539			
A3	-.1740	-.2597	-.2920	-.3238	-.3584	-.3957	-.5364	-.5589	-.6455			
A4	.1104	.1678	.1889	.2091	.2305	.2537	.3526	.3650	.4159			
A5	.0122	.0221	.0238	.0217	.0170	.0103	.0045	-.0068	-.0337			
B1	-.0158	-.0158	-.0158	-.0158	-.0158	-.0158	.0805	.0805	.0805			
B2	-1.0848	-1.0848	-1.0848	-1.0848	-1.0848	-1.0848	-1.1248	-1.1248	-1.1248			
B3	.7346	.7346	.7346	.7346	.7346	.7346	.8001	.8001	.8001			
B4	.6052	.6052	.6052	.6052	.6052	.6052	.5399	.5399	.5399			
B5	-1.1485	-1.1485	-1.1485	-1.1485	-1.1485	-1.1485	-1.1287	-1.1287	-1.1287			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 259809			QTA2 = 216723			QTA3 = 186342			
AZIMUTH AND TILT COEF.			C1 = .0132			C2 = -.2560			C3 = -.3348			
C4 = 1.5799			C5 = -1.2176									
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	14	20	25	42	53	64	69	65	58	47	34	21
QHOR:	403	669	1083	1522	1831	2022	1980	1697	1263	812	434	327

NEW YORK (LA GUARDIA), NEW YORK												
ELEVATION = 52												
LAT = 40.8												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT.	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)			
VT1/DD	193.36	66.65	45.23	33.57	26.61	21.98	18.69	16.07	12.35			
VT2/DD	165.21	56.95	38.65	28.68	22.73	18.78	15.97	13.75	10.57			
VT3/DD	143.47	49.45	33.56	24.91	19.74	16.31	13.87	11.94	9.18			
MONTHLY DD	100	290	427	576	726	879	1034	1031	1341			
ANNUAL DD	204	782	1328	2029	2861	3849	4998	6316	9495			
PARAMETER A	.640	.557	.538	.542	.538	.546	.557	.585	.661			
AZIMUTH AND TILT COEF.												
A1	.0469	.0684	.0738	.0752	.0779	.0779	.0774	.0199	.0208			
A2	.2046	.3590	.4429	.5103	.5944	.6622	.7355	.9914	1.0036			
A3	-.2061	-.3698	-.4591	-.5354	-.6324	-.7163	-.8134	-1.0992	-1.1546			
A4	.1331	.2360	.2915	.3378	.3968	.4477	.5070	.6614	.6963			
A5	.0265	.0410	.0495	.0528	.0551	.0517	.0421	.0424	.0086			
B1	-.0331	-.0331	-.0331	-.0331	-.0331	-.0331	-.0331	-.0121	-.0121			
B2	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800	-1.0800	-1.1401	-1.1401			
B3	.7280	.7279	.7279	.7279	.7279	.7279	.7279	.8061	.8061			
B4	.7081	.7081	.7081	.7081	.7081	.7081	.7081	.6462	.6462			
B5	-1.1736	-1.1736	-1.1736	-1.1736	-1.1736	-1.1736	-1.1736	-1.1582	-1.1582			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 241010 QTA2 = 201255 QTA3 = 173178												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	31	33	40	50	59	70	76	74	68	58	48	36
QHOR:	531	793	1069	1422	1545	1677	1615	1426	1206	904	559	433

NEW YORK (CENTRAL PARK), NEW YORK												
ELEVATION = 187												
LAT = 40.8												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT.	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	231.35	69.98	45.25	32.77	25.61	20.52	16.85	14.29	10.96			
VT2/DD	197.93	59.87	38.71	28.04	21.91	17.56	14.42	12.23	9.38			
VT3/DD	171.92	52.00	33.62	24.35	19.03	15.25	12.52	10.62	8.15			
MONTHLY DD	79	260	402	555	710	711	866	1021	1331			
ANNUAL DD	196	781	1330	2041	2908	3914	5085	6473	9768			
PARAMETER A	.325	.448	.459	.465	.487	.547	.622	.689	.771			
AZIMUTH AND TILT COEF.												
A1	.2016	.2075	.2458	.2885	.3114	.0831	.0864	.0868	.0886			
A2	.7682	.6303	.6848	.7333	.7663	.8152	.7817	.7698	.8259			
A3	-.6616	-.6053	-.6662	-.7200	-.7726	-.8871	-.8772	-.8895	-1.0006			
A4	.3912	.3640	.4025	.4315	.4562	.5336	.5235	.5277	.5872			
A5	.2068	.1251	.1302	.1361	.1260	.0173	-.0019	-.0203	-.0532			
B1	-.1092	-.1092	-.1092	-.1092	-.1092	-.0363	-.0363	-.0363	-.0363			
B2	-1.1468	-1.1468	-1.1468	-1.1468	-1.1468	-1.1650	-1.1649	-1.1650	-1.1649			
B3	.8010	.8010	.8010	.8010	.8010	.8336	.8335	.8336	.8335			
B4	.6799	.6799	.6799	.6799	.6799	.6492	.6492	.6492	.6492			
B5	-1.2024	-1.2024	-1.2024	-1.2024	-1.2024	-1.1640	-1.1640	-1.1640	-1.1640			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 237904 QTA2 = 198407 QTA3 = 170587												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	32	32	39	52	59	67	73	74	66	57	47	37
QHOR:	466	727	1035	1352	1657	1720	1625	1502	1189	906	524	379

ROCHESTER, NEW YORK												
ELEVATION = 554												
LAT = 43.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT.	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	39.16	19.88	15.52	12.63	10.29	8.68	7.51	6.61	5.34			
VT2/DD	33.35	16.93	13.22	10.77	8.77	7.40	6.40	5.64	4.55			
VT3/DD	28.94	14.69	11.47	9.35	7.61	6.42	5.56	4.89	3.95			
MONTHLY DD	274	540	691	836	991	1146	1146	1301	1611			
ANNUAL DD	741	1873	2656	3565	4608	5781	7110	8583	11912			
PARAMETER A	.577	.644	.676	.719	.807	.879	.942	.997	1.077			
AZIMUTH AND TILT COEF.												
A1	-.0731	-.0619	-.0573	.0275	.0248	.0234	.0227	.0224	.0228			
A2	.1853	.2068	.2168	.3497	.3214	.3068	.2995	.2973	.3104			
A3	-.1939	-.2278	-.2420	-.3929	-.3670	-.3563	-.3540	-.3577	-.3877			
A4	.1629	.1769	.1851	.2863	.2668	.2583	.2558	.2574	.2756			
A5	-.0062	-.0087	-.0104	-.0355	-.0369	-.0396	-.0432	-.0477	-.0605			
B1	-.0238	-.0238	-.0238	-.0628	-.0628	-.0628	-.0628	-.0628	-.0628			
B2	-.9112	-.9112	-.9112	-.9583	-.9583	-.9583	-.9583	-.9583	-.9583			
B3	.6093	.6093	.6093	.6749	.6748	.6748	.6748	.6748	.6748			
B4	.7106	.7106	.7106	.6459	.6459	.6459	.6459	.6459	.6459			
B5	-1.0511	-1.0511	-1.0511	-1.0243	-1.0244	-1.0244	-1.0244	-1.0244	-1.0244			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 213006 QTA2 = 177157 QTA3 = 152172												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	22	22	31	46	55	67	71	68	62	51	40	28
QHOR:	343	564	907	1353	1608	1810	1839	1524	1180	721	408	266

SYRACUSE, NEW YORK												
ELEVATION = 407												
LAT = 43.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	39.09	20.90	16.60	13.75	11.67	9.85	8.49	7.44	5.97			
VT2/DD	33.33	17.81	14.15	11.72	9.95	8.39	7.23	6.34	5.09			
VT3/DD	28.92	15.46	12.28	10.18	8.64	7.29	6.28	5.51	4.42			
MONTHLY DD	315	589	741	894	801	950	1102	1256	1566			
ANNUAL DD	793	1894	2641	3513	4512	5669	6983	8449	11793			
PARAMETER A	.492	.578	.611	.643	.678	.755	.825	.887	.977			
AZIMUTH AND TILT COEF.												
A1	-.0184	-.0196	-.0208	-.0209	-.0580	-.0506	-.0445	-.0396	-.0334			
A2	-.3342	-.3531	-.3611	-.3650	-.3637	-.3434	-.3314	-.3279	-.3470			
A3	-.3343	-.3693	-.3824	-.3934	-.4148	-.3995	-.3934	-.3976	-.4393			
A4	-.1660	-.1954	-.2088	-.2210	-.3052	-.2919	-.2851	-.2852	-.3080			
A5	-.0721	-.0578	-.0518	-.0432	-.0390	-.0422	-.0460	-.0513	-.0667			
B1	-.0063	-.0063	-.0063	-.0063	.0115	.0115	.0115	.0115	.0115			
B2	-.9528	-.9528	-.9528	-.9528	-.9490	-.9490	-.9490	-.9490	-.9490			
B3	-.6510	-.6510	-.6510	-.6510	-.6635	-.6635	-.6635	-.6635	-.6635			
B4	-.6935	-.6935	-.6935	-.6935	-.6529	-.6529	-.6529	-.6529	-.6529			
B5	-1.0677	-1.0676	-1.0676	-1.0677	-1.0270	-1.0271	-1.0271	-1.0270	-1.0270			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	21	23	32	47	57	66	70	69	62	50	40	29
QHOR:	380	530	870	1339	1573	1736	1757	1553	1144	736	395	290

ASHEVILLE, NORTH CAROLINA												
ELEVATION = 2169												
LAT = 35.4												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)			
VT1/DD	532.54	149.37	93.59	64.46	47.73	37.47	30.71	26.01	19.91			
VT2/DD	450.93	126.48	79.25	54.58	40.42	31.73	26.00	22.02	16.86			
VT3/DD	390.86	109.63	68.69	47.31	35.03	27.50	22.54	19.09	14.61			
MONTHLY DD	45	159	254	369	498	635	775	915	1195			
ANNUAL DD	156	655	1095	1668	2419	3372	4536	5936	9202			
PARAMETER A	.496	.441	.449	.474	.486	.494	.505	.517	.469			
AZIMUTH AND TILT COEF.												
A1	-.0438	-.0609	-.0638	-.0630	-.0650	-.0683	-.0706	-.0721	-.0862			
A2	-.6194	-.4459	-.3824	-.3175	-.2469	-.1571	-.0352	.1188	.5346			
A3	-.5593	-.3511	-.2830	-.2150	-.1322	-.0211	-.1324	-.3302	-.8954			
A4	-.3924	-.2720	-.2269	-.1807	-.1270	-.0574	.0364	.1548	.4780			
A5	-.1268	-.1283	-.1237	-.1182	-.1187	-.1228	-.1294	-.1386	-.1769			
B1	.0267	.0267	.0267	.0267	.0267	.0267	.0267	.0267	.0267			
B2	-.8004	-.8004	-.8004	-.8004	-.8004	-.8004	-.8004	-.8004	-.8004			
B3	-.3294	-.3294	-.3294	-.3294	-.3294	-.3294	-.3294	-.3294	-.3294			
B4	1.1329	1.1328	1.1329	1.1329	1.1329	1.1329	1.1329	1.1329	1.1329			
B5	-1.2786	-1.2785	-1.2786	-1.2786	-1.2786	-1.2786	-1.2786	-1.2786	-1.2786			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	40	37	43	56	64	69	71	70	63	55	44	40
QHOR:	709	966	1343	1686	1827	1830	1774	1582	1356	1148	851	655

CAPE HATTERAS, NORTH CAROLINA												
ELEVATION = 7												
LAT = 35.3												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	416.09	207.51	121.35	80.97	57.82	43.09	34.08	23.99			
VT2/DD	NA	352.52	175.81	102.81	68.60	48.99	36.74	29.06	20.46			
VT3/DD	NA	305.63	152.43	89.14	59.48	42.47	31.91	25.23	17.77			
MONTHLY DD	9	57	114	195	292	408	583	738	1048			
ANNUAL DD	15	152	355	700	1212	1881	2739	3787	6603			
PARAMETER A	NA	.529	.533	.458	.389	.383	.408	.434	.489			
AZIMUTH AND TILT COEF.												
A1	NA	.0324	.0396	.0614	.0957	.1160	-.0114	.0018	.0185			
A2	NA	-.4642	-.4445	-.4719	-.4292	-.2916	-.6428	.7539	.9908			
A3	NA	.3138	.2819	.2718	.1766	-.0083	-.7153	-.8784	-1.2371			
A4	NA	-.3536	-.3317	-.3575	-.3339	-.2328	.6197	.7028	.8807			
A5	NA	-.1185	-.1237	-.1406	-.1575	-.1616	-.0382	-.0620	-.1149			
B1	NA	-.0516	-.0516	-.0516	-.0516	-.0516	-.0118	-.0118	-.0118			
B2	NA	-.8319	-.8319	-.8319	-.8319	-.8319	-1.0059	-1.0059	-1.0059			
B3	NA	.3978	.3978	.3978	.3978	.3978	.5975	.5975	.5975			
B4	NA	1.1301	1.1301	1.1301	1.1301	1.1301	.8397	.8397	.8397			
B5	NA	-1.2625	-1.2626	-1.2626	-1.2626	-1.2626	-1.2575	-1.2575	-1.2574			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	46	45	51	60	67	75	78	77	73	65	55	47
QHOR:	719	971	1274	1739	1961	2048	1898	1685	1506	1171	898	637

CHARLOTTE, NORTH CAROLINA												
	TB30	TB40	TB45	TB50	ELEVATION = 768				LAT = 35.2			
SOUTH-VERT. (M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	TB55	TB60	TB65	TB70	TB80			
VT1/DD	637.55	164.48	106.47	75.45	55.38	42.47	33.94	28.00	20.67			
VT2/DD	539.46	139.18	90.09	63.84	46.86	35.94	28.72	23.69	17.49			
VT3/DD	467.52	120.62	78.08	55.33	40.61	31.15	24.89	20.53	15.16			
MONTHLY DD	35	134	207	293	399	520	650	789	1068			
ANNUAL DD	103	464	798	1265	1875	2641	3574	4708	7644			
PARAMETER A	.547	.539	.509	.475	.468	.468	.483	.519	.578			
AZIMUTH AND TILT COEF.												
A1	-.0530	-.0642	-.0745	-.0856	-.0915	-.0961	-.0968	-.0925	-.0873			
A2	-.6365	-.6295	-.6425	-.6453	-.5951	-.5242	-.4246	-.2913	-.0267			
A3	.6197	.6066	.6152	.6106	.5506	.4670	.3521	.1986	-.2000			
A4	-.3038	-.2910	-.2883	-.2754	-.2330	-.1768	-.1052	-.0173	.2095			
A5	-.1702	-.1766	-.1866	-.1986	-.2010	-.2020	-.1984	-.1900	-.1978			
B1	.0524	.0524	.0524	.0524	.0524	.0524	.0524	.0524	.0524			
B2	-.7450	-.7450	-.7450	-.7450	-.7450	-.7450	-.7450	-.7450	-.7450			
B3	.2628	.2628	.2628	.2628	.2628	.2628	.2628	.2628	.2628			
B4	1.1155	1.1155	1.1155	1.1155	1.1155	1.1155	1.1155	1.1154	1.1155			
B5	-1.2534	-1.2534	-1.2534	-1.2535	-1.2535	-1.2535	-1.2534	-1.2534	-1.2535			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 284778			QTA2 = 237355			QTA3 = 204057					
AZIMUTH AND TILT COEF.	C1 = -.0023			C2 = -.2818			C3 = -.3425					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	39	41	49	60	69	74	76	76	72	60	49	42
QHOR:	766	904	1343	1643	1825	1994	1864	1768	1450	1224	875	634

CHERRY POINT, NORTH CAROLINA												
	TB30	TB40	TB45	TB50	ELEVATION = 36				LAT = 34.9			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	TB55	TB60	TB65	TB70	TB80			
VT1/DD	NA	374.01	198.25	120.04	81.13	59.43	45.69	36.53	25.85			
VT2/DD	NA	319.08	169.14	102.41	69.22	50.70	38.98	31.17	22.05			
VT3/DD	NA	277.10	146.88	88.93	60.11	44.03	33.85	27.06	19.15			
MONTHLY DD	12	73	138	228	337	460	598	748	1057			
ANNUAL DD	23	184	412	764	1260	1899	2708	3732	6532			
PARAMETER A	NA	.621	.561	.520	.485	.463	.455	.467	.502			
AZIMUTH AND TILT COEF.												
A1	NA	.0419	.0662	.0832	.0981	.1097	.1183	.1214	.1230			
A2	NA	.2496	.3005	.3612	.4566	.5576	.6709	.7908	1.0721			
A3	NA	-.2594	-.3305	-.4082	-.5235	-.6507	-.7982	-.9631	-1.3641			
A4	NA	.1976	.2360	.2774	.3413	.4113	.4907	.5782	.7909			
A5	NA	.0059	.0016	.0016	.0037	.0010	-.0057	-.0198	-.0618			
B1	NA	-.0571	-.0571	-.0571	-.0571	-.0571	-.0571	-.0571	-.0571			
B2	NA	-1.0478	-1.0478	-1.0478	-1.0478	-1.0478	-1.0478	-1.0478	-1.0478			
B3	NA	.6382	.6382	.6382	.6381	.6382	.6382	.6382	.6382			
B4	NA	.8595	.8595	.8595	.8595	.8595	.8595	.8595	.8595			
B5	NA	-1.2627	-1.2626	-1.2627	-1.2627	-1.2627	-1.2627	-1.2627	-1.2627			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 289407			QTA2 = 241299			QTA3 = 207484					
AZIMUTH AND TILT COEF.	C1 = .0102			C2 = -.2834			C3 = -.3330					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	45	45	52	61	69	75	78	77	74	64	54	47
QHOR:	789	1048	1448	1732	1928	1997	1867	1662	1398	1125	893	732

GREENSBORO, NORTH CAROLINA												
	TB30	TB40	TB45	TB50	ELEVATION = 886				LAT = 36.1			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	TB55	TB60	TB65	TB70	TB80			
VT1/DD	606.77	162.51	100.18	68.84	51.36	40.37	32.48	27.17	20.47			
VT2/DD	518.02	138.74	85.53	58.77	43.85	34.18	27.50	23.00	17.33			
VT3/DD	449.91	120.50	74.28	51.04	38.09	29.63	23.84	19.94	15.02			
MONTHLY DD	46	172	280	407	545	576	716	856	1136			
ANNUAL DD	92	515	929	1487	2183	3022	4023	5215	8231			
PARAMETER A	.564	.513	.455	.443	.450	.470	.509	.539	.564			
AZIMUTH AND TILT COEF.												
A1	-.0303	-.0677	-.0848	-.0946	-.1003	-.0047	-.0126	-.0201	-.0368			
A2	.0598	.3408	.4400	.5099	.5685	-.4310	-.3038	-.1729	.1393			
A3	-.0817	-.3409	-.4311	-.4999	-.5713	.2500	.1138	-.0370	-.4318			
A4	.0537	.2427	.3109	.3618	.4104	-.1720	-.0831	.0111	.2467			
A5	.0012	.0579	.0796	.0884	.0827	-.2262	-.2155	-.2116	-.2269			
B1	.0633	.0633	.0633	.0633	.0633	.0376	.0376	.0376	.0376			
B2	-1.0544	-1.0544	-1.0544	-1.0544	-1.0544	-.7843	-.7843	-.7843	-.7843			
B3	.6400	.6400	.6400	.6400	.6400	.3283	.3283	.3283	.3283			
B4	.8034	.8034	.8034	.8034	.8034	1.1089	1.1089	1.1089	1.1089			
B5	-1.2795	-1.2794	-1.2794	-1.2795	-1.2795	-1.2476	-1.2476	-1.2476	-1.2476			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 290432			QTA2 = 242227			QTA3 = 208282					
AZIMUTH AND TILT COEF.	C1 = -.0121			C2 = -.3077			C3 = -.3185					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	37	39	46	59	66	73	75	75	69	58	49	40
QHOR:	750	953	1350	1775	1785	2009	1845	1691	1376	1193	854	668

RALEIGH-DURHAM, NORTH CAROLINA												
ELEVATION = 440												
LAT = 35.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	599.43	152.80	100.23	63.98	45.05	33.90	26.93	22.27	16.47			
VT2/DD	507.57	129.39	84.87	54.48	38.37	28.87	22.94	18.96	14.03			
VT3/DD	440.03	112.17	73.57	47.29	33.30	25.06	19.91	16.46	12.18			
MONTHLY DD	37	144	220	306	434	577	727	879	1188			
ANNUAL DD	84	468	841	1346	1981	2780	3753	4910	7904			
PARAMETER A	.539	.542	.436	.504	.555	.599	.627	.648	.693			
AZIMUTH AND TILT COEF.												
A1	-.0731	-.0795	-.1019	.0906	.0800	.0727	.0684	.0648	.0566			
A2	-.3654	-.3509	-.4299	.3593	.3662	.3900	.4395	.5017	.6540			
A3	.3990	.3757	.4575	-.4746	-.4850	-.5186	-.5877	-.6750	-.8945			
A4	-.2266	-.2140	-.2586	.2594	.2653	.2835	.3203	.3668	.4855			
A5	-.0233	-.0264	-.0346	-.0363	-.0380	-.0420	-.0492	-.0585	-.0863			
B1	.0346	.0346	.0346	-.0306	-.0306	-.0306	-.0306	-.0306	-.0306			
B2	-.7727	-.7727	-.7727	-.9700	-.9700	-.9700	-.9700	-.9700	-.9700			
B3	.3505	.3505	.3505	.6290	.6290	.6290	.6290	.6290	.6290			
B4	1.0960	1.0960	1.0961	.8657	.8656	.8656	.8656	.8656	.8656			
B5	-1.1827	-1.1827	-1.1827	-1.1407	-1.1406	-1.1406	-1.1406	-1.1406	-1.1407			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 260975	QTA2 = 217348			QTA3 = 186833					
AZIMUTH AND TILT COEF. C1 = -.0065 C2 = -.2162 C3 = -.3516 C4 = 1.6793 C5 = -1.1075												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	41	41	48	58	66	74	76	75	70	57	50	41
QHOR:	650	943	1265	1659	1756	1865	1832	1673	1358	1096	847	636

BISMARCK, NORTH DAKOTA												
ELEVATION = 1647												
LAT = 46.8												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	37.81	24.92	21.16	18.38	16.16	14.41	13.01	11.85	10.07			
VT2/DD	32.40	21.35	18.13	15.75	13.87	12.37	11.16	10.17	8.64			
VT3/DD	28.15	18.55	15.76	13.68	12.05	10.75	9.70	8.84	7.51			
MONTHLY DD	573	869	1023	1178	1280	1435	1590	1745	2055			
ANNUAL DD	1955	3413	4330	5365	6522	7789	9166	10680	14025			
PARAMETER A	.513	.564	.585	.611	.642	.670	.694	.717	.742			
AZIMUTH AND TILT COEF.												
A1	.0405	.0457	.0475	.0483	-.0899	-.0820	-.0752	-.0692	-.0609			
A2	.2773	.3684	.4105	.4444	.6745	.6937	.7180	.7464	.8358			
A3	-.2852	-.3779	-.4214	-.4581	-.5591	-.5963	-.6405	-.6918	-.8335			
A4	.1645	.2264	.2567	.2834	.4304	.4517	.4773	.5071	.5929			
A5	-.0044	.0042	.0071	.0079	.1295	.1165	.1026	.0862	.0501			
B1	-.0260	-.0260	-.0260	-.0260	.0264	.0264	.0264	.0264	.0264			
B2	-1.1645	-1.1645	-1.1645	-1.1645	-1.2259	-1.2259	-1.2259	-1.2259	-1.2259			
B3	.8123	.8123	.8123	.8123	.8804	.8804	.8804	.8804	.8804			
B4	.5224	.5223	.5224	.5223	.4391	.4390	.4391	.4391	.4390			
B5	-1.1847	-1.1846	-1.1847	-1.1846	-1.1902	-1.1901	-1.1902	-1.1902	-1.1902			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 308278	QTA2 = 258078			QTA3 = 222207					
AZIMUTH AND TILT COEF. C1 = .0165 C2 = -.3878 C3 = -.1867 C4 = 1.4661 C5 = -1.2829												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	12	14	27	40	55	63	70	72	55	44	28	13
QHOR:	473	783	1123	1459	1861	2081	2188	1888	1321	877	509	399

FARGO, NORTH DAKOTA												
ELEVATION = 899												
LAT = 46.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	23.83	17.32	15.22	13.57	12.24	11.15	10.24	9.46	8.22			
VT2/DD	20.43	14.85	13.04	11.63	10.49	9.56	8.78	8.11	7.05			
VT3/DD	17.75	12.90	11.34	10.11	9.12	8.31	7.63	7.05	6.13			
MONTHLY DD	815	1121	1276	1431	1586	1741	1896	2051	2361			
ANNUAL DD	2229	3734	4643	5650	6775	8027	9408	10905	14213			
PARAMETER A	.644	.678	.692	.712	.739	.769	.799	.824	.854			
AZIMUTH AND TILT COEF.												
A1	-.0287	-.0330	-.0345	-.0347	-.0340	-.0329	-.0317	-.0309	-.0306			
A2	.2372	.3119	.3473	.3746	.3978	.4183	.4397	.4661	.5444			
A3	-.2215	-.2993	-.3379	-.3701	-.4009	-.4302	-.4624	-.5018	-.6152			
A4	.1085	.1545	.1778	.1979	.2177	.2371	.2580	.2830	.3529			
A5	.0399	.0475	.0494	.0487	.0449	.0396	.0326	.0242	.0023			
B1	.0358	.0358	.0358	.0358	.0358	.0358	.0358	.0358	.0358			
B2	-1.1942	-1.1942	-1.1942	-1.1942	-1.1942	-1.1942	-1.1942	-1.1942	-1.1942			
B3	.8396	.8396	.8395	.8396	.8396	.8396	.8396	.8396	.8396			
B4	.5228	.5228	.5228	.5228	.5228	.5228	.5228	.5228	.5228			
B5	-1.1857	-1.1856	-1.1857	-1.1856	-1.1856	-1.1856	-1.1856	-1.1857	-1.1857			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 294869	QTA2 = 246700			QTA3 = 212380					
AZIMUTH AND TILT COEF. C1 = .0091 C2 = -.3542 C3 = -.2276 C4 = 1.4775 C5 = -1.2531												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	3	11	25	41	56	65	70	68	59	48	29	12
QHOR:	421	745	1139	1577	1891	1976	2163	1803	1273	890	460	351

MINOT, NORTH DAKOTA				ELEVATION = 1713				LAT = 48.3				
SOUTH-VERT. (M= 1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	26.04	18.09	15.62	13.74	12.26	11.07	10.09	9.27	7.98			
VT2/DD	22.34	15.52	13.40	11.79	10.52	9.50	8.66	7.96	6.84			
VT3/DD	19.42	13.49	11.65	10.24	9.14	8.26	7.53	6.91	5.95			
MONTHLY DD	679	978	1133	1288	1443	1598	1753	1908	2218			
ANNUAL DD	2013	3486	4426	5477	6641	7939	9373	10926	14308			
PARAMETER A	.696	.731	.755	.777	.803	.830	.858	.881	.906			
AZIMUTH AND TILT COEF.												
A1	.0698	.0701	.0689	.0674	.0655	.0634	.0613	.0595	.0579			
A2	.2003	.2715	.3033	.3347	.3633	.3911	.4179	.4474	.5264			
A3	-.1923	-.2666	-.3026	-.3396	-.3747	-.4103	-.4468	-.4885	-.5995			
A4	.1138	.1530	.1723	.1926	.2123	.2328	.2543	.2788	.3442			
A5	.0230	.0322	.0342	.0347	.0340	.0316	.0270	.0204	.0027			
B1	-.0112	-.0112	-.0112	-.0112	-.0112	-.0112	-.0112	-.0112	-.0112			
B2	-1.2178	-1.2178	-1.2178	-1.2178	-1.2178	-1.2178	-1.2178	-1.2178	-1.2178			
B3	.8694	.8694	.8695	.8695	.8695	.8695	.8695	.8695	.8695			
B4	.4797	.4797	.4797	.4797	.4797	.4797	.4797	.4797	.4797			
B5	-1.1841	-1.1841	-1.1841	-1.1841	-1.1841	-1.1841	-1.1841	-1.1841	-1.1841			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 294301	QTA2 = 246584			QTA3 = 212431					
AZIMUTH AND TILT COEF.			C1 = .0426	C2 = -.3724	C3 = -.1974	C4 = 1.4105	C5 = -1.2506					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	8	13	26	39	54	63	68	68	56	45	28	15
QHOR:	364	677	1032	1417	1967	2011	2083	1700	1240	881	441	316

AKRON-CANTON, OHIO				ELEVATION = 1237				LAT = 40.9				
SOUTH-VERT. (M= 1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	67.23	30.80	23.23	17.95	14.56	12.17	10.40	9.06	7.21			
VT2/DD	57.38	26.29	19.83	15.32	12.43	10.39	8.87	7.73	6.15			
VT3/DD	49.82	22.82	17.21	13.30	10.79	9.02	7.70	6.71	5.34			
MONTHLY DD	222	484	471	610	751	899	1053	1208	1518			
ANNUAL DD	560	1516	2204	3019	3977	5092	6358	7774	11071			
PARAMETER A	.499	.563	.604	.686	.760	.825	.884	.933	1.007			
AZIMUTH AND TILT COEF.												
A1	.0835	.0663	-.0548	-.0491	-.0448	-.0414	-.0388	-.0368	-.0345			
A2	.3636	.3950	.3508	.3412	.3358	.3372	.3440	.3553	.3958			
A3	-.3640	-.4065	-.4156	-.4048	-.4007	-.4070	-.4218	-.4428	-.5103			
A4	.1684	.1955	.3066	.2909	.2818	.2805	.2856	.2955	.3330			
A5	.0878	.0832	-.0607	-.0523	-.0478	-.0472	-.0499	-.0545	-.0702			
B1	.0085	.0085	.0538	.0538	.0538	.0538	.0538	.0538	.0538			
B2	-1.0302	-1.0302	-1.0038	-1.0038	-1.0038	-1.0038	-1.0038	-1.0038	-1.0038			
B3	.6935	.6935	.6941	.6941	.6942	.6941	.6941	.6941	.6942			
B4	.7177	.7177	.6767	.6767	.6766	.6767	.6767	.6767	.6767			
B5	-1.1433	-1.1433	-1.0815	-1.0815	-1.0815	-1.0815	-1.0815	-1.0815	-1.0815			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 229591	QTA2 = 191089			QTA3 = 164169					
AZIMUTH AND TILT COEF.			C1 = .0278	C2 = -.2117	C3 = -.3570	C4 = 1.6358	C5 = -1.1220					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	24	27	36	48	58	67	72	69	62	53	41	31
QHOR:	431	664	928	1403	1711	1877	1872	1553	1179	910	528	326

CINCINNATI, OHIO				ELEVATION = 889				LAT = 39.1				
SOUTH-VERT. (M= 1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	82.90	40.15	30.20	23.75	19.43	16.35	14.09	12.37	9.95			
VT2/DD	70.69	34.24	25.75	20.25	16.57	13.94	12.01	10.55	8.48			
VT3/DD	61.37	29.72	22.36	17.58	14.38	12.10	10.43	9.16	7.36			
MONTHLY DD	190	392	521	662	810	962	1117	1272	1582			
ANNUAL DD	329	1055	1634	2335	3162	4126	5250	6563	9680			
PARAMETER A	.734	.869	.817	.784	.764	.762	.775	.795	.831			
AZIMUTH AND TILT COEF.												
A1	.0686	.0920	.1117	.1240	.1314	.1331	.1308	.1264	.1190			
A2	.1362	.2047	.2616	.3072	.3464	.3758	.4020	.4316	.5091			
A3	-.1451	-.2354	-.3031	-.3574	-.4053	-.4438	-.4816	-.5262	-.6443			
A4	.0815	.1283	.1659	.1966	.2243	.2477	.2715	.2998	.3725			
A5	.0142	.0120	.0140	.0150	.0144	.0108	.0038	-.0061	-.0320			
B1	-.0656	-.0656	-.0656	-.0656	-.0656	-.0656	-.0656	-.0656	-.0656			
B2	-.9917	-.9917	-.9917	-.9917	-.9917	-.9917	-.9917	-.9917	-.9917			
B3	.6558	.6559	.6559	.6559	.6559	.6559	.6559	.6559	.6559			
B4	.7585	.7585	.7585	.7585	.7585	.7584	.7585	.7585	.7585			
B5	-1.1280	-1.1280	-1.1279	-1.1280	-1.1280	-1.1280	-1.1280	-1.1280	-1.1280			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 236072	QTA2 = 196528			QTA3 = 168869					
AZIMUTH AND TILT COEF.			C1 = .0244	C2 = -.2208	C3 = -.3424	C4 = 1.6367	C5 = -1.1058					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	28	32	40	52	63	73	74	74	65	56	43	38
QHOR:	481	758	1024	1370	1755	1901	1757	1616	1205	965	563	451

COLUMBUS, OHIO

ELEVATION = 833

LAT = 40.0

	TB30 (M=1)	TB40 (M=1)	TB45 (M=1)	TB50 (M=1)	TB55 (M=1)	TB60 (M=1)	TB65 (M=12)	TB70 (M=12)	TB80 (M=12)			
SOUTH-VERT. (M=1)	98.46	40.68	29.89	23.32	19.01	16.01	13.46	11.60	9.10			
VT1/DD	83.97	34.69	25.49	19.89	16.21	13.65	11.49	9.90	7.76			
VT2/DD	72.89	30.11	22.13	17.27	14.07	11.85	9.98	8.60	6.74			
VT3/DD	158	382	520	667	818	971	968	1123	1433			
MONTHLY DD	388	1216	1832	2576	3462	4507	5722	7112	10324			
ANNUAL DD	630	615	605	611	628	654	716	772	846			
PARAMETER A												
AZIMUTH AND TILT COEF.												
A1	.0391	.0526	.0544	.0534	.0506	.0464	-.0554	-.0516	-.0479			
A2	.2416	.3190	.3499	.3755	.3970	.4178	.5096	.5081	.5502			
A3	-.2278	-.3192	-.3532	-.3854	-.4165	-.4505	-.5655	-.5793	-.6616			
A4	.1356	.1898	.2130	.2348	.2550	.2760	.3701	.3757	.4213			
A5	.0554	.0596	.0612	.0588	.0530	.0440	-.0074	-.0179	-.0434			
B1	.0233	.0233	.0233	.0233	.0233	.0233	.0701	.0701	.0701			
B2	-.9886	-.9886	-.9886	-.9886	-.9886	-.9886	-1.0203	-1.0203	-1.0203			
B3	.6488	.6488	.6488	.6488	.6488	.6488	.6963	.6963	.6963			
B4	.7487	.7487	.7487	.7487	.7487	.7487	.6911	.6911	.6912			
B5	-1.1370	-1.1370	-1.1369	-1.1369	-1.1370	-1.1370	-1.1041	-1.1041	-1.1041			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 233881			QTA2 = 194826			QTA3 = 167455					
AZIMUTH AND TILT COEF.	C1 = .0425			C2 = -.2383			C3 = -.3152					
C4 = 1.6129	C5 = -.1093											
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	28	31	37	51	60	70	73	71	65	53	44	33
QHQR:	467	659	981	1312	1642	1875	1862	1610	1235	941	569	383

DAYTON, OHIO

ELEVATION = 1004

LAT = 39.9

	TB30 (M=1)	TB40 (M=12)	TB45 (M=12)	TB50 (M=12)	TB55 (M=12)	TB60 (M=12)	TB65 (M=12)	TB70 (M=12)	TB80 (M=12)			
SOUTH-VERT. (M=1)	94.93	37.76	27.27	21.05	16.93	14.08	12.02	10.48	8.35			
VT1/DD	80.98	32.21	23.26	17.95	14.45	12.01	10.25	8.94	7.12			
VT2/DD	70.31	27.96	20.19	15.58	12.54	10.42	8.90	7.76	6.18			
VT3/DD	186	337	467	605	751	904	1059	1214	1524			
MONTHLY DD	472	1315	1935	2678	3559	4572	5729	7063	10245			
ANNUAL DD	427	656	708	747	789	828	869	914	988			
PARAMETER A												
AZIMUTH AND TILT COEF.												
A1	.1274	-.0733	-.0642	-.0578	-.0522	-.0479	-.0443	-.0411	-.0369			
A2	.2647	.2466	.2624	.2770	.2884	.2986	.3090	.3207	.3262			
A3	-.2472	-.2745	-.2938	-.3134	-.3318	-.3498	-.3689	-.3907	-.4616			
A4	.1060	.2562	.2633	.2718	.2786	.2856	.2931	.3016	.3369			
A5	.0931	-.0653	-.0601	-.0581	-.0583	-.0602	-.0630	-.0667	-.0813			
B1	-.0134	.0570	.0570	.0570	.0570	.0570	.0570	.0570	.0570			
B2	-1.0056	-.9888	-.9888	-.9888	-.9888	-.9888	-.9888	-.9888	-.9888			
B3	.6595	.6634	.6634	.6634	.6634	.6634	.6634	.6634	.6634			
B4	.7510	.6973	.6973	.6973	.6973	.6974	.6974	.6974	.6973			
B5	-1.1525	-1.0905	-1.0905	-1.0905	-1.0905	-1.0905	-1.0905	-1.0905	-1.0905			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 242634			QTA2 = 202038			QTA3 = 173613					
AZIMUTH AND TILT COEF.	C1 = .0255			C2 = -.2396			C3 = -.3369					
C4 = 1.6397	C5 = -.1378											
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	29	31	37	51	62	71	73	73	65	55	42	30
QHQR:	523	734	1035	1395	1738	1890	1818	1680	1286	967	563	382

TOLEDO, OHIO

ELEVATION = 692

LAT = 41.6

	TB30 (M=12)	TB40 (M=12)	TB45 (M=12)	TB50 (M=12)	TB55 (M=12)	TB60 (M=12)	TB65 (M=12)	TB70 (M=12)	TB80 (M=12)			
SOUTH-VERT. (M=12)	69.51	29.37	21.75	17.08	13.90	11.68	10.07	8.85	7.12			
VT1/DD	59.32	25.07	18.56	14.57	11.86	9.97	8.59	7.55	6.08			
VT2/DD	51.49	21.76	16.11	12.65	10.29	8.65	7.46	6.55	5.28			
VT3/DD	163	385	520	662	814	968	1123	1278	1588			
MONTHLY DD	624	1644	2373	3242	4235	5364	6637	8071	11349			
ANNUAL DD	533	701	761	821	882	934	978	1019	1076			
PARAMETER A												
AZIMUTH AND TILT COEF.												
A1	-.1598	-.1267	-.1151	-.1032	-.0918	-.0830	-.0758	-.0698	-.0621			
A2	.2899	.2382	.2424	.2440	.2451	.2527	.2634	.2773	.3223			
A3	-.4219	-.3433	-.3400	-.3365	-.3357	-.3452	-.3597	-.3799	-.4465			
A4	.2687	.2288	.2295	.2285	.2281	.2340	.2430	.2553	.2960			
A5	-.1190	-.0942	-.0855	-.0790	-.0753	-.0749	-.0760	-.0791	-.0917			
B1	.0542	.0542	.0542	.0542	.0542	.0542	.0542	.0542	.0542			
B2	-1.0108	-1.0108	-1.0108	-1.0108	-1.0108	-1.0108	-1.0108	-1.0108	-1.0108			
B3	.7142	.7142	.7142	.7142	.7142	.7142	.7142	.7142	.7142			
B4	.6652	.6651	.6652	.6652	.6652	.6652	.6651	.6651	.6652			
B5	-1.0697	-1.0697	-1.0696	-1.0697	-1.0697	-1.0697	-1.0696	-1.0697	-1.0697			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 241051			QTA2 = 200914			QTA3 = 172717					
AZIMUTH AND TILT COEF.	C1 = .0118			C2 = -.2769			C3 = -.2898					
C4 = 1.5896	C5 = -.1382											
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	25	26	34	49	57	68	71	69	62	52	41	28
QHQR:	441	714	987	1348	1687	1898	1824	1588	1283	942	514	338

YOUNGSTOWN, OHIO

		ELEVATION = 1184								LAT = 41.3
SOUTH-VERT. (M= 2)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
VT1/DD	49.87	27.11	(M= 2)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)
VT2/DD	42.11	22.89	21.16	16.10	12.83	10.63	9.04	7.87	6.25	5.32
VT3/DD	36.47	19.82	17.87	13.72	10.94	9.06	7.71	6.71	5.32	4.62
MONTHLY DD	230	424	543	584	732	884	1039	1194	1504	1550
ANNUAL DD	679	1688	2396	3256	4271	5423	6727	8209	11550	1.007
PARAMETER A	.533	.490	.519	.620	.717	.796	.864	.926	1.007	
AZIMUTH AND TILT COEF.										
A1	.0044	-.0082	-.0132	.0103	.0061	.0034	.0015	-.0000	-.0023	
A2	-.7560	-.7733	-.6949	.4671	.4118	.3838	.3691	.3639	.3876	
A3	.6896	.6890	.6072	-.5642	-.5046	-.4773	-.4661	-.4669	-.5131	
A4	-.1858	-.1454	-.1057	.3497	.3161	.3011	.2949	.2958	.3248	
A5	-.3124	-.3546	-.3393	-.0383	-.0415	-.0457	-.0502	-.0560	-.0730	
B1	.0671	.0671	.0671	.0468	.0468	.0468	.0468	.0468	.0468	
B2	-.5390	-.5390	-.5390	-.9349	-.9349	-.9349	-.9349	-.9349	-.9349	
B3	.2150	.2150	.2150	.6428	.6428	.6428	.6428	.6428	.6428	
B4	.9612	.9612	.9612	.6850	.6850	.6850	.6850	.6850	.6850	
B5	-.9696	-.9696	-.9696	-1.0345	-1.0345	-1.0345	-1.0345	-1.0345	-1.0345	
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 212638			QTA2 = 176851			QTA3 = 151911		
AZIMUTH AND TILT COEF.		C1 = .0394			C2 = -.1648			C3 = -.3926		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC									
TAVE:	24 26 34 48 55 66 69 67 64 51 40 31									
QHOR:	403 537 911 1260 1654 1714 1760 1527 1244 820 468 298									

OKLAHOMA CITY, OKLAHOMA

		ELEVATION = 1302								LAT = 35.4
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
VT1/DD	272.48	120.99	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)
VT2/DD	232.71	103.33	85.01	62.84	48.82	39.50	33.07	28.41	21.71	18.56
VT3/DD	202.14	89.76	63.07	46.62	36.22	29.31	24.53	21.07	16.13	12.74
MONTHLY DD	115	258	367	497	639	790	944	1099	1274	1504
ANNUAL DD	208	688	1111	1652	2322	3145	4120	5246	8017	10717
PARAMETER A	.553	.476	.459	.452	.453	.469	.481	.483	.504	
AZIMUTH AND TILT COEF.										
A1	.0592	.1010	.1071	.1082	.1058	.0983	.0916	.0867	-.0505	
A2	-.2782	.5019	.5570	.5945	.6330	.6680	.7343	.8466	1.2710	
A3	-.2473	-.4835	-.5404	-.5805	-.6273	-.6817	-.7802	-.9396	-1.5516	
A4	.1568	.2935	.3279	.3531	.3822	.4146	.4713	.5621	.9133	
A5	.0737	.1054	.1133	.1165	.1145	.1019	.0845	.0633	-.0512	
B1	-.0338	-.0338	-.0338	-.0338	-.0338	-.0338	-.0338	-.0338	-.0338	
B2	-1.0753	-1.0753	-1.0754	-1.0753	-1.0753	-1.0753	-1.0753	-1.0753	-1.1201	
B3	.6408	.6408	.6408	.6408	.6408	.6408	.6408	.6408	.7247	
B4	.8164	.8164	.8163	.8164	.8164	.8164	.8163	.8164	.7473	
B5	-1.3126	-1.3126	-1.3126	-1.3126	-1.3126	-1.3127	-1.3126	-1.3126	-1.2698	
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 308846			QTA2 = 257271			QTA3 = 221049		
AZIMUTH AND TILT COEF.		C1 = -.0204			C2 = -.2465			C3 = -.4196		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC									
TAVE:	34 39 47 60 67 75 80 79 73 61 49 38									
QHOR:	812 1015 1366 1780 1874 2121 2123 2005 1606 1264 911 702									

TULSA, OKLAHOMA

		ELEVATION = 676								LAT = 36.2
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
VT1/DD	378.67	119.22	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)
VT2/DD	323.62	101.89	79.39	58.01	45.14	36.57	30.60	26.24	19.83	16.96
VT3/DD	281.12	88.51	58.94	43.07	33.51	27.15	22.72	19.48	14.73	12.64
MONTHLY DD	75	238	358	489	629	776	928	1082	1264	1504
ANNUAL DD	179	658	1079	1618	2270	3050	3964	5022	7674	10717
PARAMETER A	.360	.468	.495	.491	.474	.467	.468	.475	.527	
AZIMUTH AND TILT COEF.										
A1	-.1908	-.1458	-.1407	-.1461	-.1548	-.1592	-.1602	-.1597	-.0320	
A2	.4466	.4649	.5020	.5764	.6726	.7620	.8407	.9238	1.1005	
A3	-.4113	-.4559	-.4957	-.5751	-.6817	-.7868	-.8856	-.9977	-1.2653	
A4	.2142	.2489	.2772	.3263	.3891	.4496	.5066	.5710	.7798	
A5	.1437	.1114	.1111	.1175	.1246	.1270	.1238	.1136	-.0001	
B1	.0570	.0570	.0570	.0570	.0570	.0570	.0570	.0570	.0570	
B2	-1.0988	-1.0988	-1.0988	-1.0988	-1.0988	-1.0988	-1.0988	-1.0988	-1.1118	
B3	.6905	.6905	.6906	.6905	.6905	.6905	.6905	.6905	.7187	
B4	.7686	.7686	.7686	.7686	.7686	.7686	.7686	.7686	.7261	
B5	-1.2781	-1.2781	-1.2781	-1.2781	-1.2781	-1.2781	-1.2781	-1.2781	-1.2424	
TOTAL ANNUAL TRANSMITTED RADIATION										
DUE SOUTH AND VERTICAL		QTA1 = 288791			QTA2 = 240634			QTA3 = 206804		
AZIMUTH AND TILT COEF.		C1 = -.0106			C2 = -.2486			C3 = -.3782		
MONTH:	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC									
TAVE:	35 40 48 60 69 77 82 80 72 64 49 39									
QHOR:	730 936 1328 1576 1853 2032 2051 1906 1442 1151 850 642									

ASTORIA, OREGON

ELEVATION = 23

LAT = 46.2

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	NA	145.53	69.35	38.49	23.77	17.02	13.26	10.86	7.97			
VT2/DD	NA	124.33	59.25	32.88	20.31	14.54	11.33	9.28	6.81			
VT3/DD	NA	107.96	51.45	28.55	17.63	12.63	9.84	8.06	5.91			
MONTHLY DD	2	64	134	242	391	546	701	856	1166			
ANNUAL DD	5	192	529	1212	2271	3671	5330	7104	10722			
PARAMETER A	NA	.712	.791	.847	.907	.975	1.023	1.035	1.018			
AZIMUTH AND TILT COEF.												
A1	NA	-.0151	-.0155	-.0187	-.0200	-.0211	-.0238	-.0281	-.0366			
A2	NA	.2201	.2879	.3930	.4355	.4482	.4723	.5156	.6032			
A3	NA	-.1825	-.2650	-.3911	-.4536	-.4867	-.5336	-.5998	-.7216			
A4	NA	.1201	.1789	.2638	.3020	.3210	.3502	.3933	.4743			
A5	NA	.0562	.0482	.0412	.0301	.0143	-.0038	-.0206	-.0435			
B1	NA	.0174	.0174	.0174	.0174	.0174	.0174	.0174	.0174			
B2	NA	-1.0476	-1.0475	-1.0476	-1.0475	-1.0476	-1.0476	-1.0476	-1.0476			
B3	NA	.7572	.7572	.7572	.7572	.7572	.7572	.7572	.7572			
B4	NA	.5669	.5669	.5669	.5669	.5669	.5669	.5669	.5669			
B5	NA	-1.0500	-1.0500	-1.0499	-1.0500	-1.0500	-1.0500	-1.0500	-1.0499			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 212013	QTA2 = 177007			QTA3 = 152367					
AZIMUTH AND TILT COEF. C1 = -.0909 C2 = -.2904 C3 = -.1898 C4 = 1.4838 C5 = -1.0830												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	41	43	44	46	52	56	60	60	57	53	47	42
QHQR:	316	515	844	1160	1572	1607	1774	1467	1186	663	368	258

MEDFORD, OREGON

ELEVATION = 1299

LAT = 42.4

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	450.83	54.18	30.52	20.34	15.16	12.08	10.04	8.59	6.66			
VT2/DD	384.32	46.19	26.01	17.34	12.92	10.30	8.56	7.32	5.68			
VT3/DD	333.53	40.09	22.58	15.05	11.21	8.94	7.42	6.35	4.93			
MONTHLY DD	20	170	302	453	607	762	917	1072	1382			
ANNUAL DD	64	543	1120	1933	2954	4159	5516	6996	10233			
PARAMETER A	.674	1.093	1.174	1.223	1.251	1.278	1.303	1.321	1.340			
AZIMUTH AND TILT COEF.												
A1	.1396	.0582	.0504	.0472	.0463	.0456	.0450	.0449	.0458			
A2	.1736	.0580	.0650	.0816	.1016	.1214	.1401	.1595	.2013			
A3	-.2149	-.0760	-.0889	-.1145	-.1447	-.1749	-.2038	-.2344	-.3005			
A4	.1899	.0744	.0849	.1040	.1258	.1464	.1654	.1852	.2276			
A5	-.0592	-.0300	-.0365	-.0454	-.0548	-.0637	-.0722	-.0814	-.1014			
B1	-.1507	-.1507	-.1507	-.1507	-.1507	-.1507	-.1507	-.1507	-.1507			
B2	-.9562	-.9562	-.9562	-.9562	-.9562	-.9562	-.9562	-.9562	-.9562			
B3	.6857	.6857	.6857	.6856	.6857	.6857	.6857	.6857	.6857			
B4	.6676	.6677	.6676	.6676	.6677	.6676	.6677	.6676	.6676			
B5	-1.0325	-1.0325	-1.0325	-1.0325	-1.0325	-1.0325	-1.0325	-1.0325	-1.0325			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 270789	QTA2 = 224611			QTA3 = 192526					
AZIMUTH AND TILT COEF. C1 = -.0725 C2 = -.1407 C3 = -.5304 C4 = 1.8685 C5 = -1.2955												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	37	39	43	49	54	65	71	69	64	53	43	35
QHQR:	398	717	1135	1590	2036	2330	2528	2140	1603	980	517	289

NORTH BEND, OREGON

ELEVATION = 16

LAT = 43.4

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	NA	484.67	182.34	88.83	49.12	31.47	23.08	18.23	12.83			
VT2/DD	NA	414.18	155.84	75.92	41.97	26.89	19.73	15.58	10.96			
VT3/DD	NA	359.66	135.34	65.93	36.45	23.35	17.13	13.53	9.52			
MONTHLY DD	0	28	94	193	273	427	582	737	1047			
ANNUAL DD	0	83	293	791	1720	3120	4808	6613	10263			
PARAMETER A	NA	.544	.722	.730	.831	.946	.962	.941	.889			
AZIMUTH AND TILT COEF.												
A1	NA	-.0025	-.0337	-.0556	-.0516	-.0516	-.0588	-.0678	-.0824			
A2	NA	.1107	.2915	.4462	.4712	.4854	.5696	.6659	.8118			
A3	NA	-.1643	-.2989	-.4745	-.5634	-.6078	-.7379	-.8759	-1.0752			
A4	NA	.1396	.1935	.3172	.4112	.4363	.5253	.6225	.7650			
A5	NA	-.0634	.0311	.0253	-.0608	-.0861	-.1232	-.1558	-.1956			
B1	NA	.0087	.0141	.0141	.0087	.0087	.0087	.0087	.0087			
B2	NA	-1.0643	-1.0742	-1.0742	-1.0643	-1.0643	-1.0643	-1.0643	-1.0643			
B3	NA	.7606	.7425	.7425	.7606	.7606	.7606	.7606	.7606			
B4	NA	.6054	.6380	.6380	.6054	.6054	.6054	.6054	.6054			
B5	NA	-1.0906	-1.1350	-1.1350	-1.0906	-1.0906	-1.0906	-1.0906	-1.0906			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 268903	QTA2 = 224232			QTA3 = 192763					
AZIMUTH AND TILT COEF. C1 = -.1144 C2 = -.3551 C3 = -.2234 C4 = 1.6083 C5 = -1.2039												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	45	46	46	48	53	56	58	58	58	53	51	46
QHQR:	461	715	1120	1511	1877	1943	2044	1869	1358	915	505	368

PORTLAND, OREGON												
ELEVATION = 39												
LAT = 45.6												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)			
VT1/DD	NA	86.76	40.13	23.50	16.14	12.23	9.85	8.24	6.21			
VT2/DD	NA	73.66	34.07	19.95	13.70	10.38	8.36	7.00	5.27			
VT3/DD	NA	63.87	29.54	17.30	11.88	9.00	7.25	6.07	4.57			
MONTHLY DD	7	90	195	333	485	640	795	950	1260			
ANNUAL DD	12	251	639	1313	2255	3465	4910	6511	9965			
PARAMETER A	NA	.787	.941	1.007	1.062	1.123	1.184	1.224	1.255			
AZIMUTH AND TILT COEF.												
A1	NA	.0693	.0549	.0519	.0493	.0451	.0406	.0373	.0333			
A2	NA	-.1538	-.1075	-.0835	-.0569	-.0303	-.0041	.0218	.0711			
A3	NA	.0815	.0404	.0094	-.0229	-.0529	-.0827	-.1153	-.1841			
A4	NA	-.0180	.0119	.0402	.0659	.0866	.1049	.1256	.1715			
A5	NA	-.1165	-.1074	-.1167	-.1221	-.1227	-.1223	-.1257	-.1403			
B1	NA	-.0695	-.0695	-.0695	-.0695	-.0695	-.0695	-.0695	-.0695			
B2	NA	-.7663	-.7663	-.7663	-.7663	-.7663	-.7663	-.7663	-.7663			
B3	NA	.5429	.5430	.5430	.5430	.5430	.5429	.5429	.5430			
B4	NA	.7249	.7249	.7249	.7249	.7249	.7249	.7249	.7249			
B5	NA	-.9026	-.9026	-.9026	-.9027	-.9026	-.9026	-.9027	-.9026			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	39	42	45	49	56	63	68	64	62	53	46	40
QHQR:	294	534	897	1311	1645	1863	2085	1627	1266	742	383	253

REDMOND, OREGON												
ELEVATION = 3084												
LAT = 44.3												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	163.17	73.66	48.98	35.41	27.48	22.38	18.88	16.33	12.85			
VT2/DD	139.62	63.13	41.98	30.35	23.55	19.18	16.18	13.99	11.01			
VT3/DD	121.29	54.86	36.48	26.37	20.46	16.67	14.06	12.16	9.57			
MONTHLY DD	117	254	382	528	681	836	991	1146	1456			
ANNUAL DD	290	1115	1862	2859	4065	5430	6922	8507	11875			
PARAMETER A	.771	.796	.838	.845	.846	.843	.834	.821	.784			
AZIMUTH AND TILT COEF.												
A1	-.0495	.0363	.0386	.0415	.0428	.0432	.0431	.0431	.0433			
A2	.0400	.0406	.4533	.5180	.5869	.6589	.7388	.8238	1.0014			
A3	-.0800	-.3835	-.4510	-.5372	-.6323	-.7337	-.8464	-.9654	-1.2097			
A4	.0366	.2866	.3278	.3807	.4376	.4980	.5653	.6369	.7852			
A5	-.0279	.0418	.0303	.0189	.0043	-.0132	-.0331	-.0537	-.0934			
B1	.0713	.0212	.0212	.0212	.0212	.0212	.0212	.0212	.0212			
B2	-1.1210	-1.1878	-1.1878	-1.1878	-1.1878	-1.1878	-1.1878	-1.1878	-1.1878			
B3	.7698	.8419	.8419	.8419	.8419	.8419	.8419	.8419	.8419			
B4	.6060	.5251	.5251	.5251	.5251	.5250	.5251	.5251	.5251			
B5	-1.1703	-1.1736	-1.1736	-1.1736	-1.1736	-1.1735	-1.1736	-1.1736	-1.1736			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	33	35	38	43	50	60	67	61	57	48	40	33
QHQR:	471	767	1193	1654	2047	2343	2387	2057	1569	986	569	415

SALEM, OREGON												
ELEVATION = 200												
LAT = 44.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	653.01	130.67	61.21	31.38	19.80	14.39	11.29	9.29	6.86			
VT2/DD	556.39	111.34	52.12	26.72	16.86	12.25	9.61	7.91	5.84			
VT3/DD	482.84	96.62	45.22	23.18	14.63	10.63	8.34	6.86	5.07			
MONTHLY DD	16	81	133	259	411	565	720	875	1185			
ANNUAL DD	31	260	650	1391	2474	3790	5277	6886	10331			
PARAMETER A	.221	.880	.954	1.049	1.117	1.162	1.195	1.214	1.228			
AZIMUTH AND TILT COEF.												
A1	-.1210	-.0310	.0297	.0255	.0236	.0222	.0209	.0199	.0187			
A2	.0925	.1244	.1140	.1271	.1361	.1514	.1709	.1936	.2396			
A3	-.0056	-.1244	-.1672	-.1825	-.1973	-.2209	-.2507	-.2851	-.3551			
A4	-.0999	.0649	.1524	.1605	.1704	.1863	.2055	.2276	.2727			
A5	.1619	.0250	-.0670	-.0664	-.0712	-.0779	-.0860	-.0952	-.1139			
B1	.0038	.0038	-.0439	-.0439	-.0439	-.0439	-.0439	-.0439	-.0439			
B2	-.9309	-.9309	-.8907	-.8907	-.8907	-.8907	-.8907	-.8907	-.8907			
B3	.6384	.6384	.6395	.6394	.6394	.6394	.6394	.6394	.6395			
B4	.6950	.6950	.6550	.6550	.6550	.6550	.6550	.6550	.6550			
B5	-1.0362	-1.0362	-.9668	-.9668	-.9669	-.9668	-.9668	-.9668	-.9668			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	40	42	44	48	54	60	65	65	60	51	45	41
QHQR:	336	590	881	1386	1714	1838	2280	1820	1314	748	395	271

ALLENTOWN, PENNSYLVANIA

ELEVATION = 384 LAT = 40.7

Table with columns for months (JAN-DEC) and parameters (VT1/DD, VT2/DD, etc.). Includes sub-sections for AZIMUTH AND TILT COEF. and TOTAL ANNUAL TRANSMITTED RADIATION.

ERIE, PENNSYLVANIA

ELEVATION = 738 LAT = 42.1

Table with columns for months (JAN-DEC) and parameters (VT1/DD, VT2/DD, etc.). Includes sub-sections for AZIMUTH AND TILT COEF. and TOTAL ANNUAL TRANSMITTED RADIATION.

HARRISBURG, PENNSYLVANIA

ELEVATION = 348 LAT = 40.2

Table with columns for months (JAN-DEC) and parameters (VT1/DD, VT2/DD, etc.). Includes sub-sections for AZIMUTH AND TILT COEF. and TOTAL ANNUAL TRANSMITTED RADIATION.

PHILADELPHIA, PENNSYLVANIA				ELEVATION = 30					LAT = 39.9			
SOUTH-VERT. (M= 1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	189.86	63.54	44.27	33.40	26.61	22.06	18.78	16.34	12.98			
VT2/DD	162.13	54.26	37.81	28.52	22.73	18.83	16.04	13.96	11.08			
VT3/DD	140.79	47.11	32.83	24.77	19.73	16.36	13.92	12.12	9.62			
MONTHLY DD	103	308	441	585	734	886	1041	1196	1506			
ANNUAL DD	209	865	1449	2171	3013	3982	5112	6412	9534			
PARAMETER A	.565	.670	.648	.633	.622	.617	.626	.643	.674			
AZIMUTH AND TILT COEF.												
A1	-.0506	-.0228	-.0177	-.0131	-.0093	-.0060	-.0032	-.0014	.0002			
A2	.2373	.1852	.2522	.3294	.4115	.4881	.5508	.6017	.7291			
A3	-.2480	-.2167	-.2959	-.3879	-.4873	-.5806	-.6591	-.7269	-.9075			
A4	.1445	.1284	.1776	.2341	.2950	.3529	.4015	.4429	.5504			
A5	.0278	.0038	.0023	-.0004	-.0046	-.0094	-.0152	-.0233	-.0514			
B1	.0036	.0036	.0036	.0036	.0036	.0036	.0036	.0036	.0036			
B2	-1.0542	-1.0542	-1.0542	-1.0542	-1.0542	-1.0542	-1.0542	-1.0542	-1.0542			
B3	.7018	.7018	.7018	.7018	.7018	.7018	.7018	.7018	.7018			
B4	.7248	.7249	.7249	.7249	.7248	.7249	.7248	.7249	.7249			
B5	-1.1683	-1.1684	-1.1684	-1.1684	-1.1684	-1.1684	-1.1684	-1.1684	-1.1684			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL		QTA1 = 254166		QTA2 = 212049			QTA3 = 182360					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	31	33	42	50	62	71	76	74	68	56	45	35
QHOR:	551	781	1109	1419	1743	1813	1701	1580	1306	935	635	482

PITTSBURGH, PENNSYLVANIA				ELEVATION = 1224					LAT = 40.5			
SOUTH-VERT. (M= 1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	66.60	33.42	25.69	19.45	15.30	12.54	10.58	9.15	7.20			
VT2/DD	56.83	28.52	21.92	16.57	13.04	10.68	9.02	7.80	6.14			
VT3/DD	49.34	24.76	19.03	14.38	11.31	9.27	7.83	6.77	5.33			
MONTHLY DD	230	458	596	539	685	836	991	1146	1456			
ANNUAL DD	552	1453	2118	2899	3812	4881	6120	7539	10841			
PARAMETER A	.598	.575	.542	.603	.669	.735	.802	.867	.960			
AZIMUTH AND TILT COEF.												
A1	-.0817	-.0942	-.1016	.0428	.0376	.0332	.0292	.0259	.0222			
A2	.4448	.5587	.6321	.3747	.3566	.3430	.3333	.3305	.3610			
A3	-.4083	-.5215	-.5940	-.4486	-.4283	-.4149	-.4076	-.4109	-.4679			
A4	.2370	.2930	.3351	.3706	.3485	.3318	.3195	.3145	.3404			
A5	.1087	.1370	.1512	-.0862	-.0789	-.0742	-.0718	-.0728	-.0865			
B1	.0466	.0466	.0466	-.0069	-.0069	-.0069	-.0069	-.0069	-.0069			
B2	-1.0106	-1.0106	-1.0106	-.9373	-.9373	-.9373	-.9373	-.9373	-.9373			
B3	.6724	.6724	.6724	.6395	.6395	.6395	.6395	.6395	.6394			
B4	.7219	.7219	.7219	.7092	.7092	.7092	.7092	.7092	.7092			
B5	-1.1324	-1.1325	-1.1324	-1.0455	-1.0455	-1.0455	-1.0455	-1.0455	-1.0455			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL		QTA1 = 219177		QTA2 = 182367			QTA3 = 156679					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	26	30	35	48	61	67	71	70	65	52	41	33
QHOR:	449	588	899	1370	1624	1753	1768	1541	1230	869	525	336

WILKES-BARRE, PENNSYLVANIA				ELEVATION = 948					LAT = 41.3			
SOUTH-VERT. (M= 1)		TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
VT1/DD	69.91	32.30	24.41	19.44	16.14	13.80	12.05	10.70	8.73			
VT2/DD	59.59	27.53	20.81	16.57	13.76	11.76	10.27	9.12	7.44			
VT3/DD	51.71	23.89	18.06	14.38	11.94	10.21	8.92	7.91	6.46			
MONTHLY DD	211	457	604	759	914	1069	1224	1379	1689			
ANNUAL DD	494	1468	2180	3032	4019	5134	6407	7853	11158			
PARAMETER A	.692	.614	.618	.636	.660	.689	.723	.756	.792			
AZIMUTH AND TILT COEF.												
A1	.0374	.0512	.0512	.0487	.0454	.0418	.0380	.0347	.0305			
A2	.0204	.1336	.1834	.2270	.2640	.2945	.3232	.3568	.4548			
A3	-.0593	-.1919	-.2455	-.2940	-.3368	-.3745	-.4137	-.4617	-.6026			
A4	.0829	.1726	.2021	.2269	.2492	.2694	.2911	.3189	.4042			
A5	-.0627	-.0689	-.0617	-.0558	-.0527	-.0527	-.0567	-.0643	-.0888			
B1	-.0253	-.0253	-.0253	-.0253	-.0253	-.0253	-.0253	-.0253	-.0253			
B2	-.9511	-.9511	-.9511	-.9511	-.9511	-.9511	-.9511	-.9511	-.9511			
B3	.6335	.6334	.6335	.6335	.6335	.6334	.6335	.6334	.6334			
B4	.7276	.7277	.7276	.7277	.7277	.7277	.7277	.7277	.7277			
B5	-1.0864	-1.0864	-1.0864	-1.0864	-1.0864	-1.0864	-1.0864	-1.0864	-1.0864			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL		QTA1 = 226513		QTA2 = 188707			QTA3 = 162200					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	25	26	35	48	59	67	73	69	62	52	41	29
QHOR:	460	677	933	1381	1632	1799	1706	1516	1108	906	490	384

PROVIDENCE, RHODE ISLAND										ELEVATION = 62			LAT = 41.7			
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80							
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)		
VT1/DD	138.70	53.05	37.29	28.17	22.27	18.33	15.53	13.47	10.65							
VT2/DD	118.72	45.41	31.92	24.11	19.06	15.69	13.29	11.53	9.11							
VT3/DD	103.13	39.45	27.72	20.94	16.56	13.63	11.55	10.02	7.92							
MONTHLY DD	114	297	422	559	707	859	1014	1169	1479							
ANNUAL DD	401	1218	1899	2733	3729	4864	6147	7594	10902							
PARAMETER A	.241	.440	.509	.568	.622	.662	.699	.735	.778							
AZIMUTH AND TILT COEF.																
A1	-.0907	-.0433	-.0369	-.0339	-.0317	-.0303	-.0286	-.0267	-.0234							
A2	.8106	.6519	.6773	.6921	.6992	.7161	.7290	.7444	.8224							
A3	-.7212	-.6585	-.7035	-.7327	-.7529	-.7833	-.8116	-.8457	-.9742							
A4	.6292	.4669	.4726	.4790	.4847	.4995	.5133	.5300	.5998							
A5	.0483	.0311	.0330	.0310	.0253	.0184	.0087	-.0035	-.0333							
B1	.0157	.0157	.0157	.0157	.0157	.0157	.0157	.0157	.0157							
B2	-1.1516	-1.1516	-1.1516	-1.1516	-1.1516	-1.1516	-1.1516	-1.1516	-1.1516							
B3	.8100	.8100	.8100	.8100	.8100	.8100	.8100	.8100	.8100							
B4	.6159	.6159	.6159	.6159	.6159	.6159	.6159	.6159	.6159							
B5	-1.1608	-1.1608	-1.1608	-1.1608	-1.1608	-1.1608	-1.1608	-1.1608	-1.1608							
TOTAL ANNUAL TRANSMITTED RADIATION																
DUE SOUTH AND VERTICAL										QTA1 = 250294			QTA2 = 208990		QTA3 = 179770	
AZIMUTH AND TILT COEF.																
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC				
TAVE:	28	29	36	45	57	66	74	70	63	52	43	32				
QHOR:	510	719	1056	1352	1766	1792	1740	1510	1205	925	558	396				

CHARLESTON, SOUTH CAROLINA										ELEVATION = 39			LAT = 32.9			
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80							
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)		
VT1/DD	NA	467.31	245.97	141.53	89.98	61.42	44.75	34.64	23.64							
VT2/DD	NA	398.41	209.70	120.66	76.72	52.36	38.16	29.54	20.15							
VT3/DD	NA	345.96	182.09	104.78	66.62	45.47	33.13	25.65	17.50							
MONTHLY DD	9	49	93	162	255	374	513	663	971							
ANNUAL DD	14	148	324	627	1065	1652	2406	3362	6061							
PARAMETER A	NA	.578	.573	.556	.543	.554	.579	.604	.643							
AZIMUTH AND TILT COEF.																
A1	NA	.0155	.0207	.0244	.0280	.0301	.0313	.0317	.0323							
A2	NA	.1367	.2049	.2684	.3346	.3844	.4339	.5043	.7471							
A3	NA	-.1719	-.2496	-.3250	-.4075	-.4725	-.5390	-.6366	-.9802							
A4	NA	.1417	.1913	.2387	.2882	.3236	.3574	.4062	.5750							
A5	NA	-.0451	-.0466	-.0505	-.0560	-.0595	-.0623	-.0683	-.0903							
B1	NA	.0240	.0240	.0240	.0240	.0240	.0240	.0240	.0240							
B2	NA	-1.0501	-1.0501	-1.0501	-1.0501	-1.0501	-1.0501	-1.0501	-1.0501							
B3	NA	.6427	.6427	.6427	.6426	.6427	.6427	.6427	.6427							
B4	NA	.9291	.9291	.9291	.9291	.9291	.9291	.9291	.9291							
B5	NA	-1.2509	-1.2509	-1.2509	-1.2509	-1.2509	-1.2509	-1.2509	-1.2509							
TOTAL ANNUAL TRANSMITTED RADIATION																
DUE SOUTH AND VERTICAL										QTA1 = 272020			QTA2 = 226798		QTA3 = 195077	
AZIMUTH AND TILT COEF.																
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC				
TAVE:	48	48	56	64	71	75	78	78	74	64	56	49				
QHOR:	714	1037	1368	1754	1866	1778	1737	1593	1408	1138	1000	693				

COLUMBIA, SOUTH CAROLINA										ELEVATION = 226			LAT = 33.9			
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80							
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)		
VT1/DD	1015.30	216.39	121.37	78.63	56.49	43.01	33.98	27.71	20.03							
VT2/DD	864.66	184.28	103.37	66.96	48.11	36.63	28.94	23.60	17.05							
VT3/DD	750.59	159.97	89.73	58.13	41.76	31.80	25.12	20.49	14.80							
MONTHLY DD	22	103	183	283	394	517	655	803	1111							
ANNUAL DD	42	289	554	942	1461	2123	2942	3946	6596							
PARAMETER A	.836	.820	.795	.751	.723	.706	.704	.715	.749							
AZIMUTH AND TILT COEF.																
A1	.0224	.0358	.0400	.0460	.0481	.0475	.0444	.0401	.0313							
A2	-.0614	.0539	.0814	.0998	.1248	.1613	.2127	.2770	.4484							
A3	.0320	-.1169	-.1502	-.1755	-.2095	-.2592	-.3287	-.4163	-.6552							
A4	-.0004	.1143	.1399	.1630	.1893	.2219	.2626	.3107	.4377							
A5	-.0431	-.0641	-.0668	-.0726	-.0785	-.0848	-.0913	-.0987	-.1205							
B1	-.0056	-.0056	-.0056	-.0056	-.0056	-.0056	-.0056	-.0056	-.0056							
B2	-.9650	-.9650	-.9650	-.9650	-.9650	-.9650	-.9650	-.9650	-.9650							
B3	.5756	.5756	.5756	.5755	.5756	.5756	.5756	.5756	.5756							
B4	.8888	.8888	.8888	.8888	.8888	.8888	.8888	.8888	.8888							
B5	-1.2327	-1.2327	-1.2327	-1.2327	-1.2327	-1.2327	-1.2327	-1.2327	-1.2327							
TOTAL ANNUAL TRANSMITTED RADIATION																
DUE SOUTH AND VERTICAL										QTA1 = 280242			QTA2 = 233439		QTA3 = 200669	
AZIMUTH AND TILT COEF.																
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC				
TAVE:	44	44	54	64	71	77	80	79	72	64	52	46				
QHOR:	688	1029	1366	1722	1860	1966	1875	1730	1442	1187	904	710				

GREENVILLE, SOUTH CAROLINA

ELEVATION = 971

LAT = 34.9

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M= 1)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 12)	(M= 12)	(M= 12)	(M= 12)
VT1/DD	655.06	188.26	120.45	83.55	60.48	44.43	34.55	28.17	20.53
VT2/DD	558.87	159.48	102.04	70.78	51.23	37.96	29.52	24.07	17.54
VT3/DD	485.34	138.26	88.46	61.36	44.42	32.97	25.64	20.90	15.23
MONTHLY DD	42	128	200	288	397	528	679	833	1143
ANNUAL DD	86	361	683	1110	1720	2518	3496	4659	7637
PARAMETER A	.232	.409	.413	.404	.429	.496	.547	.572	.608
AZIMUTH AND TILT COEF.									
A1	-.0863	.0379	.0382	.0411	.0401	.0364	.0315	.0284	.0230
A2	.7008	-.5964	-.5488	-.5104	-.4176	-.6739	.7169	.8080	1.0196
A3	-.6302	.5029	.4450	.3950	.2956	-.7102	-.7965	-.9359	-1.2547
A4	.5470	-.4716	-.4383	-.4089	-.3313	.5492	.5882	.6636	.8355
A5	.1005	-.0833	-.0798	-.0801	-.0787	-.0080	-.0302	-.0516	-.0970
B1	.0148	-.0104	-.0104	-.0104	-.0104	-.0099	-.0099	-.0099	-.0099
B2	-1.0343	-.8265	-.8265	-.8265	-.8265	-1.0800	-1.0800	-1.0800	-1.0800
B3	.6287	.3516	.3516	.3516	.3516	.6857	.6857	.6857	.6857
B4	.8354	1.1391	1.1391	1.1391	1.1391	.7639	.7638	.7638	.7639
B5	-1.2692	-1.3007	-1.3008	-1.3007	-1.3008	-1.2470	-1.2469	-1.2469	-1.2470

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL

QTA1 = 286542

QTA2 = 238827

QTA3 = 205319

AZIMUTH AND TILT COEF.

C1 = -.0083

C2 = -.2888

C3 = -.3399

C4 = 1.7146

C5 = -1.2027

MONTH: JAN FEB MAR APR

MAY JUN JUL AUG

SEP OCT NOV DEC

TAVE: 40 41 50 60

65 74 75 76

71 59 51 43

QHOR: 766 961 1346 1694

1866 2015 1776 1775

1474 1191 914 625

HURON, SOUTH DAKOTA

ELEVATION = 1289

LAT = 44.4

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)
VT1/DD	31.11	19.62	16.34	13.98	12.20	10.83	9.74	8.84	7.47
VT2/DD	26.64	16.80	13.99	11.97	10.45	9.27	8.34	7.57	6.39
VT3/DD	23.14	14.59	12.15	10.40	9.08	8.06	7.24	6.58	5.56
MONTHLY DD	479	760	913	1067	1222	1377	1532	1687	1997
ANNUAL DD	1831	3149	4011	4985	6072	7273	8588	10028	13240
PARAMETER A	.616	.740	.803	.856	.904	.944	.978	1.008	1.051
AZIMUTH AND TILT COEF.									
A1	-.0033	.0015	.0034	.0052	.0069	.0085	.0099	.0112	.0134
A2	.1864	.2071	.2121	.2211	.2352	.2543	.2755	.2985	.3537
A3	-.2187	-.2346	-.2398	-.2522	-.2726	-.2998	-.3298	-.3628	-.4435
A4	.2559	.2450	.2387	.2385	.2437	.2542	.2674	.2830	.3253
A5	-.0815	-.0628	-.0566	-.0538	-.0535	-.0548	-.0572	-.0608	-.0737
B1	-.0174	-.0174	-.0174	-.0174	-.0174	-.0174	-.0174	-.0174	-.0174
B2	-1.1331	-1.1331	-1.1331	-1.1331	-1.1331	-1.1331	-1.1331	-1.1331	-1.1331
B3	.7941	.7941	.7941	.7941	.7941	.7941	.7941	.7941	.7941
B4	.5341	.5341	.5341	.5341	.5341	.5341	.5341	.5341	.5341
B5	-1.1492	-1.1492	-1.1491	-1.1491	-1.1492	-1.1492	-1.1491	-1.1491	-1.1492

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL

QTA1 = 293341

QTA2 = 244942

QTA3 = 210614

AZIMUTH AND TILT COEF.

C1 = .0149

C2 = -.3003

C3 = -.3193

C4 = 1.5676

C5 = -1.2750

MONTH: JAN FEB MAR APR

MAY JUN JUL AUG

SEP OCT NOV DEC

TAVE: 11 16 26 45

57 66 74 73

60 47 32 15

QHOR: 475 784 1142 1454

1843 2127 2230 1864

1395 951 569 348

PIERRE, SOUTH DAKOTA

ELEVATION = 1726

LAT = 44.4

	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)
VT1/DD	53.46	32.59	27.03	23.08	20.14	17.86	16.04	14.57	12.15
VT2/DD	45.83	27.94	23.17	19.78	17.26	15.31	13.75	12.49	10.43
VT3/DD	39.83	24.28	20.14	17.19	15.00	13.31	11.95	10.85	9.07
MONTHLY DD	457	750	905	1059	1214	1369	1524	1679	1823
ANNUAL DD	1257	2496	3299	4212	5243	6395	7667	9072	12220
PARAMETER A	.505	.579	.593	.607	.626	.645	.665	.682	.714
AZIMUTH AND TILT COEF.									
A1	-.0028	.0012	.0027	.0038	.0045	.0049	.0051	.0052	-.0051
A2	.2699	.3501	.4007	.4513	.4992	.5471	.5964	.6481	.8575
A3	-.2423	-.3377	-.3950	-.4543	-.5146	-.5773	-.6437	-.7150	-.9310
A4	.1283	.1850	.2187	.2532	.2879	.3241	.3625	.4040	.6014
A5	.0380	.0377	.0388	.0384	.0354	.0302	.0231	.0140	.0129
B1	.0204	.0204	.0204	.0204	.0204	.0204	.0204	.0204	.0241
B2	-1.2036	-1.2036	-1.2036	-1.2036	-1.2036	-1.2036	-1.2036	-1.2036	-1.2363
B3	.8209	.8209	.8209	.8209	.8209	.8209	.8209	.8209	.8730
B4	.5718	.5718	.5718	.5718	.5718	.5718	.5718	.5718	.4994
B5	-1.2271	-1.2271	-1.2272	-1.2272	-1.2272	-1.2272	-1.2272	-1.2272	-1.2124

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL

QTA1 = 324109

QTA2 = 270968

QTA3 = 233082

AZIMUTH AND TILT COEF.

C1 = .0247

C2 = -.3563

C3 = -.2705

C4 = 1.5373

C5 = -1.3048

MONTH: JAN FEB MAR APR

MAY JUN JUL AUG

SEP OCT NOV DEC

TAVE: 15 20 31 46

58 69 76 74

62 51 34 21

QHOR: 528 764 1226 1496

1999 2215 2256 2002

1498 1049 654 445

KNOXVILLE, TENNESSEE				ELEVATION = 981					LAT = 35.8			
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	230.40	95.06	67.23	49.61	38.19	30.36	25.02	21.23	16.27			
VT2/DD	196.45	81.05	57.33	42.30	32.56	25.89	21.33	18.10	13.87			
VT3/DD	170.56	70.37	49.77	36.72	28.27	22.48	18.52	15.71	12.04			
MONTHLY DD	94	227	321	435	565	711	863	1017	1327			
ANNUAL DD	162	584	974	1515	2196	3028	4004	5162	8108			
PARAMETER A	.741	.676	.614	.577	.550	.541	.540	.560	.610			
AZIMUTH AND TILT COEF.												
A1	.0072	.0056	.0018	-.0023	-.0059	-.0086	-.0106	-.0116	-.0109			
A2	.0937	.1931	.2646	.3479	.4285	.4969	.5686	.6282	.7723			
A3	-.0961	-.2004	-.2813	-.3776	-.4716	-.5582	-.6550	-.7452	-.9719			
A4	.0533	.1110	.1574	.2142	.2725	.3275	.3883	.4437	.5786			
A5	.0203	.0415	.0493	.0542	.0565	.0509	.0391	.0202	-.0309			
B1	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130	-.0130			
B2	-1.0030	-1.0030	-1.0030	-1.0030	-1.0030	-1.0030	-1.0030	-1.0030	-1.0030			
B3	.6281	.6282	.6282	.6281	.6281	.6281	.6282	.6282	.6281			
B4	.8229	.8229	.8229	.8229	.8229	.8229	.8229	.8229	.8229			
B5	-1.2165	-1.2165	-1.2165	-1.2165	-1.2165	-1.2165	-1.2165	-1.2165	-1.2165			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 260343	QTA2 = 216726			QTA3 = 186235				
AZIMUTH AND TILT COEF. C1 = -.0161 C2 = -.2333 C3 = -.3686 C4 = 1.7174 C5 = -1.1536												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	37	39	48	59	67	73	76	76	72	58	46	41
QHOR:	637	878	1201	1578	1817	1890	1857	1696	1378	1156	734	566

MEMPHIS, TENNESSEE				ELEVATION = 285					LAT = 35.1			
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	1025.10	186.55	104.92	68.69	49.21	37.74	30.25	25.09	18.68			
VT2/DD	867.80	158.92	89.38	58.51	41.92	32.15	25.77	21.38	15.91			
VT3/DD	752.18	137.96	77.59	50.79	36.39	27.91	22.37	18.56	13.81			
MONTHLY DD	23	121	216	330	460	600	749	903	1213			
ANNUAL DD	65	372	700	1162	1767	2493	3358	4371	7010			
PARAMETER A	.489	.558	.538	.523	.526	.534	.551	.567	.618			
AZIMUTH AND TILT COEF.												
A1	.0328	.0111	.0105	.0113	.0124	.0135	.0145	.0157	.0157			
A2	-.4932	.2247	.2685	.3059	.3266	.3540	.3888	.4386	.5699			
A3	.5161	-.2881	-.3443	-.3883	-.4113	-.4457	-.4942	-.5664	-.7630			
A4	-.4067	.1834	.2075	.2335	.2516	.2763	.3086	.3536	.4685			
A5	-.0044	-.0106	-.0072	-.0047	-.0049	-.0087	-.0175	-.0309	-.0673			
B1	-.0103	-.0056	-.0056	-.0056	-.0056	-.0056	-.0056	-.0056	-.0056			
B2	-.7977	-.9748	-.9748	-.9748	-.9748	-.9748	-.9748	-.9748	-.9748			
B3	.3192	.5954	.5954	.5954	.5954	.5954	.5954	.5954	.5954			
B4	1.1503	.8706	.8705	.8705	.8705	.8705	.8705	.8705	.8705			
B5	-1.2888	-1.2272	-1.2272	-1.2272	-1.2272	-1.2272	-1.2272	-1.2272	-1.2272			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 272252	QTA2 = 226527			QTA3 = 194596				
AZIMUTH AND TILT COEF. C1 = -.0064 C2 = -.1929 C3 = -.4513 C4 = 1.7793 C5 = -1.1812												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	40	41	51	64	71	78	81	79	73	62	49	44
QHOR:	694.	942	1255	1624	1987	2050	2030	1769	1349	1194	827	601

NASHVILLE, TENNESSEE				ELEVATION = 591					LAT = 36.1			
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	534.88	126.19	78.17	53.56	39.33	30.46	24.36	20.28	15.19			
VT2/DD	456.28	107.65	66.80	45.77	33.60	25.99	20.78	17.30	12.96			
VT3/DD	396.15	93.46	58.02	39.75	29.19	22.56	18.04	15.02	11.25			
MONTHLY DD	35	149	240	350	477	616	770	925	1235			
ANNUAL DD	99	500	874	1374	2018	2803	3742	4880	7756			
PARAMETER A	.319	.411	.483	.533	.560	.579	.605	.627	.675			
AZIMUTH AND TILT COEF.												
A1	.1999	.1314	-.0205	-.0288	-.0357	.0548	.0467	.0399	.0303			
A2	.3765	.3486	.6162	.6165	.6490	.4751	.5134	.5644	.6826			
A3	-.4175	-.4039	-.6108	-.6304	-.6805	-.5738	-.6269	-.6992	-.8775			
A4	.2449	.2457	.4061	.4206	.4546	.3705	.4055	.4513	.5571			
A5	.0090	-.0079	.0674	.0506	.0391	-.0332	-.0410	-.0522	-.0848			
B1	-.0083	-.0083	.0284	.0284	.0284	-.0083	-.0083	-.0083	-.0083			
B2	-1.0362	-1.0362	-1.0991	-1.0991	-1.0991	-1.0362	-1.0362	-1.0362	-1.0362			
B3	.6761	.6761	.7437	.7437	.7437	.6761	.6762	.6761	.6762			
B4	.8184	.8183	.7475	.7475	.7475	.8184	.8183	.8184	.8184			
B5	-1.2136	-1.2136	-1.2188	-1.2188	-1.2188	-1.2136	-1.2136	-1.2136	-1.2136			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 253081	QTA2 = 210388			QTA3 = 180633				
AZIMUTH AND TILT COEF. C1 = .0046 C2 = -.2387 C3 = -.3701 C4 = 1.7787 C5 = -1.1807												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	40	42	49	58	67	75	78	76	71	60	50	40
QHOR:	553	808	1180	1561	1720	2032	1919	1758	1418	1062	691	509

ABILENE, TEXAS

ELEVATION = 1752

LAT = 32.4

	T830	T840	T845	T850	T855	T860	T865	T870	T880						
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)						
VT1/DD	799.56	238.83	149.15	102.28	74.61	57.39	46.06	38.23	28.35						
VT2/DD	683.14	204.05	127.43	87.39	63.75	49.03	39.35	32.66	24.22						
VT3/DD	593.53	177.29	110.72	75.93	55.39	42.60	34.19	28.38	21.04						
MONTHLY DD	42	141	226	330	452	588	732	882	1189						
ANNUAL DD	67	326	610	1024	1562	2224	3032	3989	6479						
PARAMETER A	.572	.682	.648	.587	.543	.527	.522	.512	.483						
AZIMUTH AND TILT COEF.															
A1	.0091	.0023	.0016	.0017	.0021	.0024	.0031	.0049	.0124						
A2	.0601	.2646	.3658	.4809	.5896	.6736	.7609	.8927	1.2718						
A3	-.0333	-.2641	-.3685	-.4839	-.5983	-.6952	-.8089	-.9881	-1.5115						
A4	.0520	.2065	.2807	.3655	.4462	.5097	.5788	.6842	.9811						
A5	.0143	.0146	.0220	.0321	.0383	.0372	.0269	.0068	-.0470						
B1	-.0394	-.0394	-.0394	-.0394	-.0394	-.0394	-.0394	-.0394	-.0394						
B2	-1.0918	-1.0918	-1.0918	-1.0918	-1.0918	-1.0918	-1.0918	-1.0918	-1.0918						
B3	.6483	.6483	.6483	.6483	.6483	.6483	.6483	.6483	.6483						
B4	.8163	.8163	.8163	.8163	.8162	.8163	.8162	.8162	.8163						
B5	-1.3270	-1.3271	-1.3271	-1.3271	-1.3271	-1.3270	-1.3270	-1.3270	-1.3271						
TOTAL ANNUAL TRANSMITTED RADIATION															
DUE SOUTH AND VERTICAL	QTA1 = 315053			QTA2 = 262355			QTA3 = 225453								
AZIMUTH AND TILT COEF.	C1 = -.0204			C2 = -.1847			C3 = -.5094			C4 = 1.8380			C5 = -1.2504		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
TAVE:	43	47	53	65	71	78	82	83	77	63	55	41			
QHOR:	904	1205	1566	1916	2062	2216	2092	1954	1552	1347	1013	858			

AMARILLO, TEXAS

ELEVATION = 3602

LAT = 35.2

	T830	T840	T845	T850	T855	T860	T865	T870	T880						
SOUTH-VERT. (M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)						
VT1/DD	555.18	171.19	113.92	82.11	62.80	50.12	41.38	35.17	27.04						
VT2/DD	470.88	145.19	96.62	69.64	53.26	42.51	35.10	29.83	22.93						
VT3/DD	408.29	125.89	83.78	60.38	46.19	36.86	30.43	25.86	19.88						
MONTHLY DD	59	191	287	399	521	653	791	931	1211						
ANNUAL DD	213	829	1333	1976	2756	3671	4732	5973	8937						
PARAMETER A	.526	.426	.429	.444	.455	.461	.469	.478	.456						
AZIMUTH AND TILT COEF.															
A1	-.0104	-.0109	-.0071	-.0036	-.0005	.0023	.0047	.0068	.0110						
A2	-.4770	-.5273	-.4318	-.3258	-.2171	-.0896	.0514	.2059	.6149						
A3	.2922	.2822	.1715	.0545	-.0705	-.2260	-.3973	-.5865	-1.1400						
A4	-.3004	-.3289	-.2638	-.1902	-.1124	-.0181	.0874	.2051	.5325						
A5	-.1738	-.2165	-.2142	-.2088	-.2076	-.2126	-.2182	-.2262	-.2858						
B1	-.0071	-.0071	-.0071	-.0071	-.0071	-.0071	-.0071	-.0071	-.0071						
B2	-.8724	-.8724	-.8724	-.8724	-.8724	-.8724	-.8724	-.8724	-.8724						
B3	.3553	.3553	.3553	.3553	.3553	.3553	.3553	.3553	.3553						
B4	1.1066	1.1066	1.1066	1.1066	1.1066	1.1066	1.1066	1.1066	1.1066						
B5	-1.3814	-1.3815	-1.3814	-1.3814	-1.3814	-1.3814	-1.3814	-1.3814	-1.3814						
TOTAL ANNUAL TRANSMITTED RADIATION															
DUE SOUTH AND VERTICAL	QTA1 = 369046			QTA2 = 307509			QTA3 = 264119								
AZIMUTH AND TILT COEF.	C1 = .0036			C2 = -.2686			C3 = -.4656			C4 = 1.8042			C5 = -1.3706		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
TAVE:	35	36	46	55	65	73	77	75	68	58	44	35			
QHOR:	999	1180	1740	2041	2242	2342	2360	2166	1768	1462	1037	873			

AUSTIN, TEXAS

ELEVATION = 620

LAT = 30.3

	T830	T840	T845	T850	T855	T860	T865	T870	T880						
SOUTH-VERT. (M= 3)	(M= 3)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)						
VT1/DD	NA	1212.90	447.52	210.35	122.10	82.28	60.35	46.82	31.48						
VT2/DD	NA	1032.84	381.08	179.12	103.97	70.06	51.39	39.87	26.81						
VT3/DD	NA	896.83	330.90	155.53	90.28	60.84	44.62	34.62	23.28						
MONTHLY DD	1	24	65	138	237	352	480	619	920						
ANNUAL DD	2	73	215	484	870	1378	2026	2847	5158						
PARAMETER A	NA	.498	.439	.412	.413	.415	.423	.429	.440						
AZIMUTH AND TILT COEF.															
A1	NA	-.1274	-.1473	-.1553	-.1528	-.1486	-.1427	-.1388	-.1351						
A2	NA	.5330	.5615	.5716	.5758	.6178	.6780	.7879	1.1156						
A3	NA	-.6655	-.6959	-.7018	-.7020	-.7484	-.8225	-.9702	-1.4199						
A4	NA	.4008	.4273	.4381	.4410	.4692	.5112	.5904	.8230						
A5	NA	-.0165	-.0140	-.0098	-.0067	-.0034	-.0046	-.0137	-.0375						
B1	NA	.0039	.0039	.0039	.0039	.0039	.0039	.0039	.0039						
B2	NA	-.9787	-.9787	-.9787	-.9787	-.9787	-.9787	-.9787	-.9787						
B3	NA	.5434	.5433	.5434	.5434	.5434	.5434	.5434	.5434						
B4	NA	.9546	.9546	.9546	.9546	.9546	.9546	.9546	.9546						
B5	NA	-1.2944	-1.2945	-1.2945	-1.2945	-1.2944	-1.2945	-1.2945	-1.2944						
TOTAL ANNUAL TRANSMITTED RADIATION															
DUE SOUTH AND VERTICAL	QTA1 = 285473			QTA2 = 237697			QTA3 = 204387								
AZIMUTH AND TILT COEF.	C1 = -.0485			C2 = -.1326			C3 = -.5253			C4 = 1.8623			C5 = -1.1605		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
TAVE:	50	53	57	69	74	80	83	83	78	68	57	51			
QHOR:	889	1105	1487	1550	1845	2074	2131	1921	1602	1333	1019	877			

BROWNSVILLE, TEXAS

Table with columns for months (JAN-DEC) and parameters (TB30-TB80, AZIMUTH AND TILT COEF., RADIATION). Includes ELEVATION = 20 and LAT = 25.9.

CORPUS CHRISTI, TEXAS

Table with columns for months (JAN-DEC) and parameters (TB30-TB80, AZIMUTH AND TILT COEF., RADIATION). Includes ELEVATION = 43 and LAT = 27.8.

DEL RIO, TEXAS

Table with columns for months (JAN-DEC) and parameters (TB30-TB80, AZIMUTH AND TILT COEF., RADIATION). Includes ELEVATION = 1027 and LAT = 29.4.

EL PASO, TEXAS

		TB30	TB40	TB45	TB50	ELEVATION = 3917		TB65	TB70	TB80	LAT = 31.8	
SOUTH-VERT. (M=1)		(M=1)	(M=1)	(M=1)	(M=1)	TB55	TB60	(M=1)	(M=1)	(M=1)	(M=1)	
VT1/DD		2410.57	431.50	247.38	158.85	109.62	80.66	62.30	50.41	36.30		
VT2/DD		2055.82	368.00	210.98	135.47	93.49	68.79	53.13	42.99	30.96		
VT3/DD		1785.69	319.65	183.25	117.67	81.20	59.75	46.15	37.34	26.89		
MONTHLY DD		17	93	162	252	366	497	643	795	1104		
ANNUAL DD		28	222	458	825	1334	2001	2826	3808	6326		
PARAMETER A		.594	.551	.582	.560	.558	.545	.532	.520	.494		
AZIMUTH AND TILT COEF.												
A1		.0088	.0171	.0254	.0389	.0489	.0589	.0679	.0770	.0943		
A2		.0293	.0566	.1229	.2075	.2809	.3786	.4941	.6379	1.0423		
A3		-.0557	-.1009	-.1838	-.2905	-.3839	-.5120	-.6672	-.8642	-1.4391		
A4		.0381	.0700	.1242	.1944	.2538	.3321	.4239	.5376	.8588		
A5		-.0156	-.0246	-.0318	-.0410	-.0495	-.0632	-.0817	-.1066	-.1889		
B1		-.0138	-.0138	-.0138	-.0138	-.0138	-.0138	-.0138	-.0138	-.0138		
B2		-1.0479	-1.0479	-1.0479	-1.0479	-1.0479	-1.0479	-1.0479	-1.0479	-1.0479		
B3		.5780	.5779	.5779	.5779	.5780	.5780	.5780	.5780	.5779		
B4		.9303	.9303	.9303	.9304	.9303	.9303	.9303	.9303	.9303		
B5		-1.3684	-1.3683	-1.3683	-1.3684	-1.3683	-1.3684	-1.3683	-1.3683	-1.3683		
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 377967			QTA2 = 314267			QTA3 = 269783			
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	44	48	56	65	74	81	82	80	73	64	52	44
QHQR:	1102	1535	1908	2329	2632	2690	2480	2268	1937	1698	1252	1040

FORT WORTH, TEXAS

		TB30	TB40	TB45	TB50	ELEVATION = 538		TB65	TB70	TB80	LAT = 32.0	
SOUTH-VERT. (M=1)		(M=1)	(M=1)	(M=1)	(M=1)	TB55	TB60	(M=1)	(M=1)	(M=1)	(M=1)	
VT1/DD		1407.21	281.07	163.72	103.83	72.00	53.11	41.26	33.53	24.17		
VT2/DD		1199.90	239.66	139.60	88.53	61.39	45.28	35.18	28.59	20.61		
VT3/DD		1042.01	208.13	121.23	76.88	53.32	39.32	30.55	24.83	17.89		
MONTHLY DD		19	94	162	255	368	499	642	790	1097		
ANNUAL DD		34	229	449	793	1257	1870	2643	3598	6093		
PARAMETER A		.540	.603	.594	.593	.597	.610	.615	.612	.593		
AZIMUTH AND TILT COEF.												
A1		.0050	.0155	.0181	.0185	.0179	.0164	.0151	.0141	.0142		
A2		.0423	.2034	.2355	.2670	.3056	.3443	.4120	.5228	.8065		
A3		-.1230	-.2829	-.3137	-.3462	-.3915	-.4417	-.5342	-.6841	-1.0635		
A4		.0802	.2066	.2329	.2568	.2857	.3137	.3639	.4454	.6502		
A5		-.0657	-.0583	-.0561	-.0549	-.0564	-.0604	-.0698	-.0830	-.1087		
B1		-.0341	-.0341	-.0341	-.0341	-.0341	-.0341	-.0341	-.0341	-.0341		
B2		-1.0367	-1.0367	-1.0367	-1.0367	-1.0367	-1.0367	-1.0367	-1.0367	-1.0367		
B3		.6173	.6173	.6173	.6173	.6173	.6173	.6173	.6173	.6173		
B4		.9032	.9032	.9032	.9032	.9032	.9032	.9032	.9032	.9032		
B5		-1.2868	-1.2868	-1.2868	-1.2867	-1.2867	-1.2868	-1.2868	-1.2868	-1.2868		
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 295886			QTA2 = 246312			QTA3 = 211661			
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	44	49	53	63	70	80	86	83	74	67	56	46
QHQR:	778	1057	1464	1527	1867	2178	2216	2044	1690	1272	954	761

HOUSTON, TEXAS

		TB30	TB40	TB45	TB50	ELEVATION = 108		TB65	TB70	TB80	LAT = 30.0	
SOUTH-VERT. (M=12)		(M=12)	(M=12)	(M=12)	(M=12)	TB55	TB60	(M=12)	(M=12)	(M=12)	(M=12)	
VT1/DD	NA	722.10	355.13	191.73	112.79	75.11	53.65	40.66	26.00			
VT2/DD	NA	614.48	302.19	163.15	95.98	63.92	45.65	34.60	22.07			
VT3/DD	NA	533.39	262.32	141.62	83.32	55.48	39.63	30.03	19.15			
MONTHLY DD	2	30	61	113	192	288	403	532	813			
ANNUAL DD	2	52	146	314	589	1001	1580	2349	4612			
PARAMETER A	NA	.647	.454	.405	.475	.520	.557	.565	.624			
AZIMUTH AND TILT COEF.												
A1	NA	.0435	.1029	.1232	.1023	.0906	.0815	.0772	-.0284			
A2	NA	.1916	.4208	.5275	.4820	.5115	.5611	.6452	.5254			
A3	NA	-.2126	-.4453	-.5624	-.5263	-.5783	-.6520	-.7691	-.7532			
A4	NA	.1318	.2692	.3389	.3177	.3505	.3960	.4649	.4628			
A5	NA	.0021	.0278	.0322	.0189	.0039	-.0092	-.0233	-.1210			
B1	NA	-.0592	-.0592	-.0592	-.0592	-.0592	-.0592	-.0592	-.0592			
B2	NA	-.9441	-.9441	-.9441	-.9441	-.9441	-.9441	-.9441	-.9441			
B3	NA	.5564	.5564	.5564	.5564	.5564	.5564	.5564	.5564			
B4	NA	.9378	.9378	.9378	.9378	.9378	.9378	.9378	.9378			
B5	NA	-1.1896	-1.1896	-1.1896	-1.1896	-1.1896	-1.1896	-1.1896	-1.1896			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 254511			QTA2 = 211879			QTA3 = 182253			
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	53	53	60	68	75	81	82	81	78	70	63	53
QHQR:	777	1099	1349	1564	1814	1878	1852	1606	1500	1254	961	727

KINGSVILLE, TEXAS												
	TB30	TB40	TB45	TB50	ELEVATION = 56		LAT = 27.5					
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	TB55	TB60	TB65	TB70	TB80			
VT1/DD	NA	NA	1130.33	414.43	208.13	121.54	80.40	57.28	34.55			
VT2/DD	NA	NA	958.87	351.57	176.56	103.10	68.20	48.59	29.31			
VT3/DD	NA	NA	832.08	305.08	153.21	89.47	59.19	42.16	25.43			
MONTHLY DD	0	8	23	62	123	210	318	446	740			
ANNUAL DD	0	13	53	158	351	649	1066	1649	3571			
PARAMETER A	NA	NA	.621	.695	.643	.610	.579	.562	.594			
AZIMUTH AND TILT COEF.												
A1	NA	NA	.1195	.1025	.1176	.1298	.1401	.1449	.1282			
A2	NA	NA	.0287	.1061	.1763	.2122	.2497	.2992	.4949			
A3	NA	NA	-.0361	-.1358	-.2264	-.2711	-.3179	-.3835	-.6558			
A4	NA	NA	.0639	.1189	.1807	.2144	.2461	.2847	.4215			
A5	NA	NA	-.0240	-.0292	-.0399	-.0456	-.0496	-.0551	-.0699			
B1	NA	NA	-.0882	-.0882	-.0882	-.0882	-.0882	-.0882	-.0882			
B2	NA	NA	-.8444	-.8444	-.8444	-.8444	-.8444	-.8444	-.8444			
B3	NA	NA	.3849	.3849	.3849	.3849	.3849	.3849	.3849			
B4	NA	NA	1.0917	1.0917	1.0917	1.0917	1.0917	1.0917	1.0917			
B5	NA	NA	-1.2509	-1.2509	-1.2509	-1.2509	-1.2509	-1.2509	-1.2509			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 267215	QTA2 = 222179			QTA3 = 190999					
AZIMUTH AND TILT COEF.			C1 = -.0164	C2 = .0036	C3 = -.6516	C4 = 1.9385	C5 = -1.0583					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	56	59	67	73	78	82	84	84	81	72	63	59
QHQR:	923	1153	1435	1600	1872	2034	2139	1940	1701	1335	1071	858

LAREDO, TEXAS												
	TB30	TB40	TB45	TB50	ELEVATION = 518		LAT = 27.5					
SOUTH-VERT. (M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	TB55	TB60	TB65	TB70	TB80			
VT1/DD	NA	NA	1586.46	599.46	282.17	155.03	96.39	66.96	39.41			
VT2/DD	NA	NA	1350.45	510.28	240.20	131.59	81.82	56.84	33.54			
VT3/DD	NA	NA	1172.71	443.12	208.58	114.22	71.01	49.34	29.13			
MONTHLY DD	0	4	17	46	97	184	295	425	693			
ANNUAL DD	0	9	45	144	339	643	1082	1676	3503			
PARAMETER A	NA	NA	.394	.392	.372	.383	.410	.433	.475			
AZIMUTH AND TILT COEF.												
A1	NA	NA	.1313	.1611	.1996	-.1961	-.1727	-.1590	.1630			
A2	NA	NA	.2824	.4178	.5579	-.1753	.2653	.3627	.9658			
A3	NA	NA	-.3052	-.4576	-.6199	-.1968	-.3158	-.4435	-1.2058			
A4	NA	NA	.2730	.3675	.4561	.1345	.1879	.2489	.7060			
A5	NA	NA	-.0037	.0054	.0153	.0056	.0053	.0045	-.0190			
B1	NA	NA	-.1119	-.1119	-.1119	-.0109	-.0109	-.0109	-.1119			
B2	NA	NA	-.9725	-.9725	-.9725	-.8945	-.8945	-.8945	-.9725			
B3	NA	NA	.5310	.5310	.5310	.4038	.4038	.4038	.5310			
B4	NA	NA	.9889	.9889	.9889	1.1179	1.1179	1.1179	.9889			
B5	NA	NA	-1.3045	-1.3045	-1.3045	-1.3264	-1.3264	-1.3264	-1.3045			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 273824	QTA2 = 227630			QTA3 = 195639					
AZIMUTH AND TILT COEF.			C1 = -.0371	C2 = -.0042	C3 = -.6765	C4 = 1.9929	C5 = -1.1057					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	56	60	67	75	80	85	86	86	82	75	63	57
QHQR:	977	1210	1475	1740	2005	2081	2143	2025	1645	1309	1026	856

LUBBOCK, TEXAS												
	TB30	TB40	TB45	TB50	ELEVATION = 3241		LAT = 33.7					
SOUTH-VERT. (M= 2)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	TB55	TB60	TB65	TB70	TB80			
VT1/DD	678.16	199.53	125.28	88.27	67.15	53.54	44.38	37.86	29.26			
VT2/DD	574.43	170.46	107.03	75.41	57.36	45.74	37.91	32.34	25.00			
VT3/DD	498.00	148.11	92.99	65.52	49.84	39.74	32.94	28.10	21.72			
MONTHLY DD	52	200	319	452	595	746	900	1055	1365			
ANNUAL DD	141	608	1026	1568	2242	3055	4000	5125	7923			
PARAMETER A	.563	.481	.518	.540	.544	.541	.531	.521	.480			
AZIMUTH AND TILT COEF.												
A1	.0149	-.0871	-.0810	-.0793	-.0797	-.0801	-.0807	-.0813	-.0866			
A2	-.5072	.4654	.4679	.4789	.5267	.6093	.7231	.8670	1.3057			
A3	-.4392	-.5176	-.5265	-.5456	-.6155	-.7261	-.8827	-1.0822	-1.7006			
A4	-.3020	.3286	.3327	.3449	.3842	.4497	.5383	.6502	.9966			
A5	-.1043	.0286	.0225	.0155	.0056	-.0103	-.0298	-.0546	-.1376			
B1	-.0009	.0321	.0321	.0321	.0321	.0321	.0321	.0321	.0321			
B2	-.8527	-1.1115	-1.1115	-1.1115	-1.1115	-1.1115	-1.1115	-1.1115	-1.1115			
B3	.2807	.6343	.6343	.6343	.6343	.6343	.6343	.6343	.6343			
B4	1.1958	.8691	.8692	.8691	.8691	.8692	.8691	.8691	.8691			
B5	-1.4079	-1.3693	-1.3693	-1.3693	-1.3693	-1.3693	-1.3692	-1.3693	-1.3692			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL			QTA1 = 370525	QTA2 = 308417			QTA3 = 264818					
AZIMUTH AND TILT COEF.			C1 = .0027	C2 = -.2118	C3 = -.5594	C4 = 1.9166	C5 = -1.3614					
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	35	41	48	59	69	76	79	77	72	60	48	41
QHQR:	1018	1320	1781	2255	2376	2605	2479	2274	1806	1520	1159	926

LUFKIN, TEXAS

		ELEVATION = 315										LAT = 31.2	
		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)		(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	373.52	201.46	128.30	87.44	64.00	49.42	39.25	26.76				
VT2/DD	NA	317.70	171.35	109.13	74.37	54.44	42.04	33.38	22.76				
VT3/DD	NA	275.77	148.73	94.72	64.56	47.25	36.49	28.98	19.76				
MONTHLY DD	7	69	127	200	293	400	518	652	957				
ANNUAL DD	15	166	329	580	952	1457	2095	2929	5390				
PARAMETER A	NA	.527	.594	.601	.583	.543	.524	.530	.572				
AZIMUTH AND TILT COEF.													
A1	NA	-.0347	-.0233	-.0130	-.0040	.0036	.0100	.0148	.0229				
A2	NA	-.0087	-.0337	.1215	.2147	.2999	.3798	.4714	.7212				
A3	NA	-.0315	-.0802	-.1890	-.3034	-.4086	-.5101	-.6347	-.9889				
A4	NA	.0443	.0721	.1377	.2082	.2759	.3391	.4100	.5983				
A5	NA	-.0499	-.0485	-.0540	-.0592	-.0658	-.0737	-.0861	-.1204				
B1	NA	-.0657	-.0657	-.0657	-.0657	-.0657	-.0657	-.0657	-.0657				
B2	NA	-.9196	-.9196	-.9196	-.9196	-.9196	-.9196	-.9196	-.9196				
B3	NA	.5022	.5022	.5022	.5022	.5022	.5022	.5022	.5022				
B4	NA	.9560	.9560	.9560	.9560	.9561	.9560	.9560	.9560				
B5	NA	-1.2425	-1.2425	-1.2425	-1.2425	-1.2425	-1.2425	-1.2425	-1.2425				
TOTAL ANNUAL TRANSMITTED RADIATION													
DUE SOUTH AND VERTICAL		QTA1 = 274869			QTA2 = 228683			QTA3 = 196542					
AZIMUTH AND TILT COEF.		C1 = -.0447		C2 = -.1143		C3 = -.5323		C4 = 1.8533		C5 = -1.1556			
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
TAVE:	49	52	58	67	74	79	81	81	77	67	57	51	
QHOR:	832	1082	1399	1636	1822	2056	1986	1886	1558	1355	888	746	

MIDLAND-ODESSA, TEXAS

		ELEVATION = 2858										LAT = 31.9	
		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)		(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	417.42	213.95	131.87	91.21	68.45	54.19	44.72	33.09				
VT2/DD	NA	356.20	182.57	112.53	77.84	58.41	46.24	38.16	28.23				
VT3/DD	NA	309.45	158.61	97.76	67.62	50.74	40.18	33.15	24.53				
MONTHLY DD	7	94	184	299	432	576	727	881	1191				
ANNUAL DD	22	255	542	953	1491	2148	2953	3935	6547				
PARAMETER A	NA	.511	.566	.578	.569	.560	.555	.559	.542				
AZIMUTH AND TILT COEF.													
A1	NA	-.0984	-.0932	-.0967	-.1031	-.1091	-.1140	-.1172	-.1274				
A2	NA	.2317	.2590	.3045	.3797	.4644	.5539	.6584	1.0330				
A3	NA	-.2848	-.3200	-.3766	-.4708	-.5788	-.6958	-.8400	-1.3837				
A4	NA	.1595	.1826	.2175	.2728	.3350	.4016	.4825	.7833				
A5	NA	-.0005	-.0056	-.0097	-.0154	-.0228	-.0323	-.0498	-.1313				
B1	NA	.0442	.0442	.0442	.0442	.0442	.0442	.0442	.0442				
B2	NA	-1.0791	-1.0791	-1.0791	-1.0791	-1.0791	-1.0791	-1.0791	-1.0791				
B3	NA	.5924	.5924	.5924	.5925	.5925	.5924	.5925	.5924				
B4	NA	.9285	.9285	.9285	.9284	.9285	.9285	.9285	.9285				
B5	NA	-1.3731	-1.3730	-1.3731	-1.3730	-1.3731	-1.3731	-1.3731	-1.3731				
TOTAL ANNUAL TRANSMITTED RADIATION													
DUE SOUTH AND VERTICAL		QTA1 = 364494			QTA2 = 303376			QTA3 = 260588					
AZIMUTH AND TILT COEF.		C1 = -.0252		C2 = -.1757		C3 = -.5947		C4 = 1.9519		C5 = -1.3313			
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
TAVE:	41	46	54	65	73	79	80	78	73	66	52	45	
QHOR:	1068	1390	1925	2210	2433	2612	2400	2146	1817	1556	1205	1030	

PORT ARTHUR, TEXAS

		ELEVATION = 23										LAT = 30.0	
		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)		(M=12)	(M=12)	(M=12)	(M=12)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)			
VT1/DD	NA	1329.84	532.18	270.32	147.41	86.87	57.87	41.79	26.51				
VT2/DD	NA	1133.28	453.52	230.36	125.22	73.80	49.16	35.50	22.52				
VT3/DD	NA	984.08	393.81	200.04	108.67	64.04	42.66	30.81	19.54				
MONTHLY DD	0	18	45	89	151	257	385	533	841				
ANNUAL DD	1	44	129	300	595	1025	1628	2439	4815				
PARAMETER A	NA	.545	.455	.351	.367	.471	.537	.579	.632				
AZIMUTH AND TILT COEF.													
A1	NA	.0020	-.0088	-.0016	.1654	.1324	.1199	.1141	.1074				
A2	NA	.4933	.6336	.8957	.2441	.2312	.2778	.3509	.5752				
A3	NA	-.5287	-.6726	-.9619	-.3811	-.3516	-.4053	-.4991	-.8062				
A4	NA	.2918	.3652	.5273	.2846	.2488	.2648	.3066	.4587				
A5	NA	.0485	.0725	.0914	-.1284	-.1023	-.0908	-.0885	-.1021				
B1	NA	-.0308	-.0308	-.0308	-.0713	-.0713	-.0713	-.0713	-.0713				
B2	NA	-1.0215	-1.0215	-1.0215	-.8957	-.8957	-.8957	-.8957	-.8957				
B3	NA	.6120	.6120	.6120	.4815	.4816	.4816	.4816	.4816				
B4	NA	.9328	.9328	.9328	1.0285	1.0284	1.0285	1.0285	1.0284				
B5	NA	-1.2458	-1.2458	-1.2458	-1.2172	-1.2171	-1.2172	-1.2172	-1.2172				
TOTAL ANNUAL TRANSMITTED RADIATION													
DUE SOUTH AND VERTICAL		QTA1 = 260515			QTA2 = 216787			QTA3 = 186397					
AZIMUTH AND TILT COEF.		C1 = .0044		C2 = -.1074		C3 = -.5130		C4 = 1.8486		C5 = -1.0899			
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
TAVE:	52	53	60	68	74	79	81	81	77	68	58	54	
QHOR:	787	1083	1395	1608	1850	2018	1835	1658	1518	1297	971	758	

SAN ANGELO, TEXAS												
ELEVATION = 1909												
LAT = 31.4												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	2423.74	444.15	246.08	148.99	98.64	71.29	54.76	44.10	31.39			
VT2/DD	2070.55	379.43	209.76	127.00	84.08	60.77	46.67	37.59	26.76			
VT3/DD	1798.99	329.66	182.19	110.31	73.03	52.78	40.54	32.65	23.24			
MONTHLY DD	15	82	135	223	337	466	606	753	1058			
ANNUAL DD	36	240	464	784	1229	1800	2512	3387	5795			
PARAMETER A	.119	.363	.383	.444	.474	.487	.494	.503	.511			
AZIMUTH AND TILT COEF.												
A1	-.3628	-.1316	.0225	.0178	.0161	.0143	.0111	.0070	.0014			
A2	1.7246	.7733	.3461	.3829	.4252	.4874	.5619	.6537	.9348			
A3	-1.0124	-.8351	-.3671	-.4207	-.4768	-.5579	-.6560	-.7800	-1.1763			
A4	.9361	.4602	.3460	.3569	.3808	.4242	.4794	.5482	.7633			
A5	.3306	.1088	-.0330	-.0305	-.0308	-.0349	-.0416	-.0514	-.0913			
B1	.0190	.0190	-.0174	-.0174	-.0174	-.0174	-.0174	-.0174	-.0174			
B2	-1.1075	-1.1075	-1.0139	-1.0139	-1.0139	-1.0139	-1.0138	-1.0138	-1.0139			
B3	.6698	.6698	.5414	.5413	.5414	.5414	.5413	.5413	.5414			
B4	.8585	.8585	.9273	.9273	.9273	.9273	.9273	.9273	.9273			
B5	-1.3460	-1.3460	-1.3437	-1.3437	-1.3436	-1.3436	-1.3436	-1.3437	-1.3436			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA1 = 318557			QTA2 = 265267		QTA3 = 227983		
AZIMUTH AND TILT COEF.												
C1 = -.0130			C2 = -.1763			C3 = -.5297			C4 = 1.8735		C5 = -1.2525	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	45	50	55	66	75	80	83	81	77	66	56	47
QHQR:	936	1222	1660	1903	2067	2174	2170	1959	1682	1319	1075	952

SAN ANTONIO, TEXAS												
ELEVATION = 794												
LAT = 29.5												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	NA	689.39	342.79	198.89	125.01	85.83	63.36	48.98	32.39			
VT2/DD	NA	587.40	292.07	169.47	106.52	73.13	53.99	41.73	27.59			
VT3/DD	NA	510.10	253.64	147.17	92.50	63.51	46.88	36.24	23.96			
MONTHLY DD	3	41	83	143	227	331	448	580	877			
ANNUAL DD	4	78	200	425	771	1242	1844	2609	4879			
PARAMETER A	NA	.692	.696	.571	.495	.471	.460	.452	.459			
AZIMUTH AND TILT COEF.												
A1	NA	.0485	.0633	.0919	.1116	.1179	.1201	.1202	.1113			
A2	NA	.0702	.1959	.3719	.5045	.6093	.7251	.8731	1.2344			
A3	NA	-.0906	-.2395	-.4391	-.5891	-.7147	-.8595	-1.0554	-1.5442			
A4	NA	.0540	.1477	.2758	.3714	.4476	.5333	.6435	.9074			
A5	NA	-.0090	-.0107	-.0056	-.0010	-.0016	-.0062	-.0181	-.0441			
B1	NA	-.1015	-.1015	-.1015	-.1015	-.1015	-.1015	-.1015	-.1015			
B2	NA	-.9964	-.9964	-.9964	-.9964	-.9964	-.9964	-.9964	-.9964			
B3	NA	.5729	.5730	.5729	.5729	.5729	.5729	.5729	.5729			
B4	NA	.9230	.9230	.9229	.9230	.9230	.9230	.9229	.9229			
B5	NA	-1.2855	-1.2855	-1.2855	-1.2855	-1.2854	-1.2854	-1.2854	-1.2854			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA1 = 280269			QTA2 = 233238		QTA3 = 200519		
AZIMUTH AND TILT COEF.												
C1 = -.0924			C2 = -.1215			C3 = -.5398			C4 = 1.9101		C5 = -1.1503	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	51	54	61	68	73	80	84	83	79	69	59	51
QHQR:	934	1131	1467	1559	1855	2080	2175	1890	1664	1324	991	854

SHERMAN, TEXAS												
ELEVATION = 764												
LAT = 33.7												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	1663.85	251.15	138.18	87.93	62.16	47.38	37.95	31.37	23.13			
VT2/DD	1419.62	214.28	117.90	75.02	53.03	40.42	32.38	26.77	19.74			
VT3/DD	1232.91	186.10	102.39	65.15	46.06	35.11	28.12	23.25	17.14			
MONTHLY DD	16	108	197	309	437	574	716	866	1175			
ANNUAL DD	30	222	477	872	1407	2091	2920	3902	6435			
PARAMETER A	.491	.728	.694	.648	.599	.571	.550	.539	.549			
AZIMUTH AND TILT COEF.												
A1	-.0550	-.0464	-.0659	-.0832	-.0975	-.1068	-.1145	-.1206	-.1238			
A2	.2532	.2047	.2711	.3348	.3955	.4552	.5386	.6466	.8788			
A3	-.3299	-.2549	-.3213	-.3839	-.4445	-.5088	-.6123	-.7562	-1.0793			
A4	.2139	.1663	.2132	.2599	.3069	.3530	.4183	.5022	.6794			
A5	-.0362	-.0175	-.0085	-.0005	.0049	.0069	.0011	-.0115	-.0426			
B1	.0451	.0451	.0451	.0451	.0451	.0451	.0451	.0451	.0451			
B2	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327	-1.0327			
B3	.6173	.6173	.6172	.6173	.6173	.6172	.6172	.6173	.6173			
B4	.8355	.8354	.8355	.8355	.8355	.8355	.8355	.8355	.8354			
B5	-1.2717	-1.2717	-1.2717	-1.2717	-1.2717	-1.2717	-1.2717	-1.2717	-1.2716			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL					QTA1 = 292410			QTA2 = 243401		QTA3 = 209133		
AZIMUTH AND TILT COEF.												
C1 = -.0181			C2 = -.1871			C3 = -.4729			C4 = 1.7973		C5 = -1.2103	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	42	47	51	64	71	79	83	83	77	65	53	45
QHQR:	759	1028	1465	1627	1902	2112	2066	1925	1652	1260	910	713

WACO, TEXAS										ELEVATION = 509					LAT = 31.6																			
SOUTH-VERT. (M= 1)										TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	TB85															
VT1/DD	NA	326.27	186.57	118.58	80.16	57.83	44.02	35.24	24.90	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)															
VT2/DD	NA	277.68	158.78	100.92	68.22	49.22	37.46	29.99	21.19																									
VT3/DD	NA	241.07	137.85	87.61	59.23	42.73	32.52	26.04	18.40																									
MONTHLY DD	13	79	138	217	321	445	585	731	1035																									
ANNUAL DD	25	196	399	714	1157	1729	2443	3300	5601																									
PARAMETER A	NA	.664	.610	.552	.552	.557	.571	.573	.598																									
AZIMUTH AND TILT COEF.																																		
A1	NA	.0688	.0779	.0888	.0891	.0880	.0846	.0827	.0738																									
A2	NA	.1782	.1883	.2247	.2465	.2788	.3181	.3801	.5616																									
A3	NA	-.2285	-.2458	-.2938	-.3206	-.3597	-.4084	-.4890	-.7403																									
A4	NA	.1922	.2184	.2684	.2929	.3218	.3528	.4017	.5336																									
A5	NA	-.0506	-.0648	-.0817	-.0873	-.0909	-.0934	-.0997	-.1187																									
B1	NA	-.0738	-.0738	-.0738	-.0738	-.0738	-.0738	-.0738	-.0738																									
B2	NA	-.9332	-.9332	-.9332	-.9332	-.9332	-.9332	-.9332	-.9332																									
B3	NA	.4975	.4975	.4975	.4975	.4975	.4975	.4975	.4975																									
B4	NA	.9297	.9296	.9296	.9296	.9296	.9296	.9296	.9296																									
B5	NA	-1.2604	-1.2604	-1.2603	-1.2604	-1.2603	-1.2603	-1.2604	-1.2603																									
TOTAL ANNUAL TRANSMITTED RADIATION																																		
DUE SOUTH AND VERTICAL										QTA1 = 285595					QTA2 = 237614					QTA3 = 204200														
AZIMUTH AND TILT COEF.																																		
MONTH: JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC										C1 = -.0520					C2 = -.1245					C3 = -.5457					C4 = 1.8687					C5 = -1.1801				
TAVE: 46 48 55 68 74 82 84 84 77 68 55 49																																		
QHOR: 801 1119 1488 1654 1919 2128 2206 1938 1537 1235 952 810																																		

WICHITA FALLS, TEXAS										ELEVATION = 1030					LAT = 34.0																			
SOUTH-VERT. (M= 12)										TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	TB85															
VT1/DD	821.27	206.04	125.48	85.78	63.49	49.44	40.01	33.39	24.95	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)															
VT2/DD	702.01	175.75	107.03	73.17	54.16	42.17	34.13	28.48	21.28																									
VT3/DD	609.89	152.64	92.96	63.55	47.03	36.62	29.64	24.74	18.48																									
MONTHLY DD	39	148	244	356	481	618	764	915	1225																									
ANNUAL DD	102	463	786	1225	1793	2508	3378	4402	6994																									
PARAMETER A	.543	.410	.445	.459	.455	.478	.503	.516	.522																									
AZIMUTH AND TILT COEF.																																		
A1	-.0371	.0163	.0123	.0099	.0080	.0061	.0043	.0023	-.0012																									
A2	.4692	.3342	.3631	.3939	.4420	.4770	.5380	.6397	.9262																									
A3	-.4926	-.3787	-.4073	-.4392	-.4935	-.5441	-.6341	-.7778	-1.1757																									
A4	.3084	.2714	.2901	.3133	.3512	.3797	.4281	.5081	.7309																									
A5	.0422	-.0032	.0004	.0021	.0016	-.0066	-.0203	-.0379	-.0792																									
B1	.0137	-.0051	-.0051	-.0051	-.0051	-.0051	-.0051	-.0051	-.0051																									
B2	-1.1104	-1.0296	-1.0296	-1.0296	-1.0296	-1.0296	-1.0296	-1.0296	-1.0296																									
B3	.6939	.5867	.5866	.5866	.5866	.5866	.5866	.5866	.5866																									
B4	.7799	.8659	.8659	.8659	.8659	.8659	.8659	.8659	.8659																									
B5	-1.2934	-1.3049	-1.3050	-1.3050	-1.3049	-1.3050	-1.3050	-1.3050	-1.3050																									
TOTAL ANNUAL TRANSMITTED RADIATION																																		
DUE SOUTH AND VERTICAL										QTA1 = 313769					QTA2 = 261258					QTA3 = 224470														
AZIMUTH AND TILT COEF.																																		
MONTH: JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC										C1 = -.0162					C2 = -.2091					C3 = -.4753					C4 = 1.8060					C5 = -1.2500				
TAVE: 40 43 51 63 69 79 84 82 74 66 51 41																																		
QHOR: 846 1141 1561 1803 2092 2198 2115 1935 1617 1274 950 823																																		

BRYCE CANYON, UTAH										ELEVATION = 7589					LAT = 37.7																			
SOUTH-VERT. (M= 1)										TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80	TB85															
VT1/DD	122.18	68.37	54.76	45.58	39.02	34.11	30.30	27.26	22.11	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)															
VT2/DD	104.68	58.57	46.91	39.05	33.43	29.23	25.96	23.35	17.69																									
VT3/DD	90.99	50.91	40.78	33.94	29.06	25.40	22.57	20.30	14.85																									
MONTHLY DD	344	615	768	922	1077	1232	1387	1542	1057																									
ANNUAL DD	1352	2929	3969	5147	6450	7884	9431	11088	14616																									
PARAMETER A	.533	.494	.474	.454	.429	.397	.357	.310	.348																									
AZIMUTH AND TILT COEF.																																		
A1	.0380	.0507	.0562	.0616	.0680	.0767	.0889	.1062	-.0088																									
A2	.6295	1.0064	1.2122	1.4309	1.6898	2.0203	2.4588	3.0538	-9.0433																									
A3	-.7364	-1.1932	-1.4561	-1.7387	-2.0753	-2.5050	-3.0721	-3.8331	12.2737																									
A4	.3649	.6140	.7566	.9095	1.0906	1.3213	1.6246	2.0308	-6.4512																									
A5	.0028	-.0138	-.0327	-.0544	-.0807	-.1133	-.1528	-.1969	1.1358																									
B1	.0044	.0044	.0044	.0044	.0044	.0044	.0044	.0044	.0868																									
B2	-1.2067	-1.2067	-1.2067	-1.2067	-1.2067	-1.2067	-1.2067	-1.2067	1.4007																									
B3	.7453	.7453	.7453	.7453	.7453	.7453	.7453	.7453	-2.5107																									
B4	.7244	.7244	.7244	.7244	.7244	.7244	.7244	.7244	3.3945																									
B5	-1.3460	-1.3460	-1.3460	-1.3460	-1.3460	-1.3460	-1.3460	-1.3460	-1.4186																									
TOTAL ANNUAL TRANSMITTED RADIATION																																		
DUE SOUTH AND VERTICAL										QTA1 = 402394					QTA2 = 335723					QTA3 = 288411														
AZIMUTH AND TILT COEF.																																		
MONTH: JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC										C1 = .0623					C2 = -.2410					C3 = -.4918					C4 = 1.7383					C5 = -1.4163				
TAVE: 20 23 28 37 45 56 63 58 51 41 29 21																																		
QHOR: 921 1245 1693 2201 2434 2613 2426 2178 1961 1463 1027 841																																		

CEDAR CITY, UTAH

ELEVATION = 5617										LAT = 37.7		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)		
VT1/DD	251.94	103.10	73.92	56.28	45.06	37.54	32.17	28.14	22.51			
VT2/DD	215.99	88.39	63.37	48.25	38.63	32.18	27.58	24.13	19.30			
VT3/DD	187.74	76.83	55.08	41.94	33.58	27.97	23.97	20.97	16.78			
MONTHLY DD	138	338	472	619	774	929	1084	1239	1549			
ANNUAL DD	456	1364	2055	2890	3865	4984	6258	7679	10868			
PARAMETER A	.495	.507	.517	.523	.522	.519	.520	.518	.479			
AZIMUTH AND TILT COEF.												
A1	-.1104	-.0853	-.0784	-.0738	-.0711	-.0695	-.0675	-.0658	-.0667			
A2	-.5882	-.8468	-.9297	-1.0318	-1.1511	-1.2825	-1.3989	-1.5325	-1.9776			
A3	-.6061	-.8698	-.9771	-1.1137	-1.2737	-1.4513	-1.6147	-1.8065	-2.4246			
A4	-.3602	-.5069	-.5632	-.6355	-.7210	-.8161	-.9038	-1.0073	-1.3446			
A5	.0189	.0474	.0395	.0262	.0096	-.0096	-.0311	-.0602	-.1426			
B1	.0380	.0380	.0380	.0380	.0380	.0380	.0380	.0380	.0380			
B2	-1.2279	-1.2279	-1.2279	-1.2279	-1.2279	-1.2279	-1.2279	-1.2279	-1.2279			
B3	.7970	.7970	.7970	.7970	.7970	.7970	.7970	.7970	.7970			
B4	.6626	.6626	.6626	.6626	.6626	.6626	.6626	.6626	.6626			
B5	-1.2980	-1.2979	-1.2979	-1.2979	-1.2979	-1.2979	-1.2979	-1.2979	-1.2979			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	29	33	38	47	57	68	73	71	65	50	38	30
QHOR:	906	1168	1570	2122	2513	2659	2517	2223	1993	1484	992	756

SALT LAKE CITY, UTAH

ELEVATION = 4226										LAT = 40.8		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)		
VT1/DD	133.39	60.13	44.20	34.59	28.34	23.99	20.80	18.36	14.87			
VT2/DD	114.13	51.45	37.82	29.60	24.25	20.53	17.80	15.71	12.72			
VT3/DD	99.16	44.70	32.86	25.72	21.07	17.84	15.46	13.65	11.05			
MONTHLY DD	182	403	549	701	856	1011	1166	1321	1631			
ANNUAL DD	395	1263	1957	2812	3814	4969	6251	7646	10748			
PARAMETER A	.568	.732	.776	.804	.823	.834	.838	.837	.820			
AZIMUTH AND TILT COEF.												
A1	-.0088	-.0057	-.0043	-.0033	-.0024	-.0014	-.0006	-.0002	.0017			
A2	-.1312	-.0069	-.0751	-.1501	-.2248	-.3001	-.3781	-.4585	-.6295			
A3	.0762	-.0538	-.1313	-.2226	-.3164	-.4137	-.5177	-.6273	-.8648			
A4	-.0176	-.0688	-.1168	-.1720	-.2276	-.2845	-.3446	-.4076	-.5441			
A5	-.0827	-.0691	-.0717	-.0787	-.0874	-.0980	-.1112	-.1268	-.1638			
B1	-.0013	-.0013	-.0013	-.0013	-.0013	-.0013	-.0013	-.0013	-.0013			
B2	-1.1304	-1.1304	-1.1304	-1.1304	-1.1304	-1.1304	-1.1304	-1.1304	-1.1304			
B3	.7409	.7409	.7409	.7409	.7409	.7409	.7409	.7409	.7409			
B4	.6648	.6648	.6648	.6648	.6648	.6648	.6648	.6648	.6648			
B5	-1.2193	-1.2194	-1.2194	-1.2194	-1.2193	-1.2194	-1.2193	-1.2193	-1.2193			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	27	34	41	48	57	67	78	74	65	51	38	28
QHOR:	596	991	1518	1916	2312	2529	2628	2307	1863	1307	752	558

BURLINGTON, VERMONT

ELEVATION = 341										LAT = 44.5		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)	(M=1)		
VT1/DD	42.90	24.89	19.91	16.38	13.87	11.96	10.47	9.31	7.63			
VT2/DD	36.70	21.30	17.04	14.01	11.86	10.23	8.96	7.97	6.52			
VT3/DD	31.88	18.50	14.80	12.17	10.30	8.88	7.78	6.92	5.67			
MONTHLY DD	395	680	655	797	941	1092	1246	1401	1711			
ANNUAL DD	1180	2430	3260	4214	5310	6552	7945	9483	12912			
PARAMETER A	.468	.563	.621	.678	.735	.789	.839	.881	.936			
AZIMUTH AND TILT COEF.												
A1	.0137	.0110	.0442	.0438	.0428	.0415	.0402	.0389	.0372			
A2	.5654	.5290	.5282	.5131	.5010	.4945	.4927	.4979	.5377			
A3	-.5338	-.5096	-.5776	-.5667	-.5598	-.5602	-.5666	-.5820	-.6516			
A4	.3187	.3108	.4026	.3921	.3845	.3823	.3848	.3934	.4361			
A5	.0979	.0812	-.0256	-.0266	-.0287	-.0327	-.0384	-.0457	-.0672			
B1	-.0039	-.0039	-.0154	-.0154	-.0154	-.0154	-.0154	-.0154	-.0154			
B2	-1.1052	-1.1052	-1.1048	-1.1048	-1.1048	-1.1048	-1.1048	-1.1048	-1.1048			
B3	.7547	.7548	.7850	.7850	.7850	.7850	.7850	.7850	.7851			
B4	.6040	.6040	.5604	.5604	.5604	.5604	.5604	.5604	.5604			
B5	-1.1649	-1.1649	-1.1165	-1.1165	-1.1165	-1.1165	-1.1165	-1.1165	-1.1165			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	18	20	27	41	54	64	70	67	58	49	38	24
QHOR:	420	706	1073	1423	1734	2045	1975	1651	1265	829	434	329

NORFOLK, VIRGINIA

ELEVATION = 30										LAT = 36.9		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)		
VT1/DD	670.09	173.32	105.29	63.13	43.09	32.60	26.21	21.92	16.51			
VT2/DD	572.63	148.12	89.98	53.45	36.48	27.60	22.19	18.56	13.98			
VT3/DD	497.39	128.65	78.16	46.33	31.62	23.92	19.24	16.09	12.12			
MONTHLY DD	41	159	261	297	435	575	715	855	1135			
ANNUAL DD	48	368	764	1302	1971	2778	3736	4875	7798			
PARAMETER A	.340	.509	.346	.463	.571	.637	.671	.695	.750			
AZIMUTH AND TILT COEF.												
A1	.0094	.1183	.2165	-.2242	-.1770	-.1572	-.1499	-.1451	-.1326			
A2	-.0084	.4235	.8522	-.7410	-.5457	-.4382	-.3579	-.2774	-.0808			
A3	-.0076	-.4124	-.8173	.5844	.4116	.3078	.2202	.1277	-.1089			
A4	-.0053	.1639	.3538	-.2244	-.1411	-.0848	-.0322	.0231	.1559			
A5	-.0095	.1354	.2591	-.3315	-.2677	-.2437	-.2376	-.2354	-.2351			
B1	-.0393	-.0393	-.0393	.0885	.0885	.0885	.0885	.0885	.0885			
B2	-1.1089	-1.1089	-1.1089	-.7389	-.7389	-.7389	-.7389	-.7389	-.7389			
B3	-.7122	-.7122	-.7122	.3318	.3319	.3319	.3318	.3318	.3318			
B4	.7817	.7816	.7817	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540			
B5	-1.2555	-1.2555	-1.2555	-1.1589	-1.1588	-1.1588	-1.1589	-1.1589	-1.1589			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 279113			QTA2 = 232584			QTA3 = 199876					
AZIMUTH AND TILT COEF.	C1 = .0046			C2 = -.2934		C3 = -.3243		C4 = 1.6957		C5 = -1.1985		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	39	39	47	60	67	74	78	76	71	57	53	41
QHQR:	737	796	1240	1646	1912	2018	1905	1711	1490	1012	881	572

RICHMOND, VIRGINIA

ELEVATION = 164										LAT = 37.5		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 2)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)		
VT1/DD	462.79	114.75	72.25	51.06	38.75	31.08	25.87	22.11	17.12			
VT2/DD	392.36	97.97	61.69	43.60	33.09	26.53	22.09	18.88	14.62			
VT3/DD	340.22	85.08	53.57	37.86	28.73	23.04	19.18	16.39	12.69			
MONTHLY DD	47	205	325	461	607	757	909	1063	1373			
ANNUAL DD	115	595	1023	1587	2299	3154	4165	5354	8341			
PARAMETER A	.341	.534	.603	.623	.622	.613	.610	.613	.611			
AZIMUTH AND TILT COEF.												
A1	-.1393	.1175	.1006	.0953	.0932	.0918	.0887	.0841	.0767			
A2	-.8262	.3025	.2945	.3313	.3872	.4540	.5231	.6042	.8413			
A3	-.6981	-.2930	-.2980	-.3464	-.4167	-.4995	-.5888	-.6982	-1.0256			
A4	-.4589	.1883	.1889	.2165	.2560	.3027	.3520	.4110	.5874			
A5	-.1989	.0561	.0450	.0420	.0399	.0384	.0341	.0258	-.0032			
B1	-.0517	-.0251	-.0251	-.0251	-.0251	-.0251	-.0251	-.0251	-.0251			
B2	-.8165	-1.0612	-1.0612	-1.0612	-1.0612	-1.0612	-1.0612	-1.0612	-1.0612			
B3	-.3952	.6763	.6763	.6763	.6763	.6763	.6763	.6763	.6763			
B4	1.0516	.7876	.7876	.7876	.7876	.7876	.7876	.7876	.7876			
B5	-1.2162	-1.2233	-1.2233	-1.2233	-1.2233	-1.2233	-1.2233	-1.2233	-1.2233			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 267831			QTA2 = 223505			QTA3 = 192257					
AZIMUTH AND TILT COEF.	C1 = .0080			C2 = -.3006		C3 = -.2735		C4 = 1.5953		C5 = -1.1485		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	35	39	46	58	66	71	77	76	69	58	49	41
QHQR:	661	882	1236	1524	1685	1856	1772	1632	1402	995	743	569

ROANOKE, VIRGINIA

ELEVATION = 1175										LAT = 37.3		
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 2)	(M= 2)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)		
VT1/DD	384.29	111.19	69.80	49.16	37.52	30.17	25.11	21.47	16.65			
VT2/DD	325.87	94.83	59.53	41.92	32.00	25.73	21.41	18.31	14.20			
VT3/DD	282.56	82.33	51.69	36.40	27.78	22.34	18.59	15.90	12.33			
MONTHLY DD	61	207	329	467	612	761	915	1070	1380			
ANNUAL DD	154	662	1118	1722	2484	3387	4451	5708	8795			
PARAMETER A	.433	.556	.604	.617	.623	.621	.626	.640	.647			
AZIMUTH AND TILT COEF.												
A1	.0461	-.0692	-.0709	-.0756	-.0807	-.0870	-.0913	-.0930	-.0972			
A2	-.6152	.2131	.2211	.2496	.2901	.3456	.4021	.4649	.6770			
A3	.5400	-.2613	-.2753	-.3138	-.3663	-.4369	-.5098	-.5952	-.8923			
A4	-.3942	.2146	.2218	.2464	.2821	.3317	.3808	.4328	.6053			
A5	-.1299	-.0279	-.0315	-.0366	-.0430	-.0512	-.0594	-.0697	-.1059			
B1	.0003	.0324	.0324	.0324	.0324	.0324	.0324	.0324	.0324			
B2	-.8194	-.9990	-.9990	-.9990	-.9990	-.9990	-.9990	-.9990	-.9990			
B3	.3710	.6175	.6175	.6175	.6174	.6175	.6175	.6175	.6175			
B4	1.0423	.7954	.7954	.7954	.7954	.7954	.7954	.7954	.7954			
B5	-1.2446	-1.2157	-1.2157	-1.2157	-1.2158	-1.2157	-1.2157	-1.2157	-1.2158			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 274142			QTA2 = 228703			QTA3 = 196694					
AZIMUTH AND TILT COEF.	C1 = -.0268			C2 = -.2964		C3 = -.3020		C4 = 1.6294		C5 = -1.1782		
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAKE:	35	38	44	56	64	72	75	73	69	56	47	39
QHQR:	660	904	1259	1578	1749	1953	1806	1588	1387	1086	750	581

OLYMPIA, WASHINGTON												
ELEVATION = 200												
LAT = 47.0												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	515.23	82.50	37.58	21.13	14.38	10.89	8.76	7.33	5.53			
VT2/DD	439.23	70.33	32.01	18.00	12.25	9.27	7.46	6.24	4.71			
VT3/DD	381.21	61.04	27.77	15.62	10.63	8.05	6.48	5.42	4.08			
MONTHLY DD	18	109	185	329	484	639	794	949	1259			
ANNUAL DD	35	416	939	1793	2929	4301	5851	7507	11027			
PARAMETER A	.678	.869	.971	1.084	1.153	1.209	1.248	1.271	1.289			
AZIMUTH AND TILT COEF.												
A1	.0168	-.0220	-.0012	-.0037	-.0059	-.0079	-.0099	-.0117	-.0149			
A2	.0047	.1406	.0822	.0898	.1036	.1194	.1380	.1581	.1985			
A3	.0009	-.1405	-.1330	-.1378	-.1533	-.1736	-.1996	-.2283	-.2866			
A4	-.0020	.0797	.1338	.1312	.1387	.1497	.1649	.1828	.2203			
A5	.0070	.0218	-.0756	-.0677	-.0659	-.0669	-.0709	-.0766	-.0898			
B1	.0301	.0301	.0134	.0134	.0134	.0134	.0134	.0134	.0134			
B2	-.9500	-.9500	-.9066	-.9066	-.9066	-.9066	-.9066	-.9066	-.9066			
B3	.6595	.6595	.6566	.6566	.6566	.6566	.6566	.6566	.6566			
B4	.6533	.6533	.6177	.6177	.6177	.6177	.6177	.6177	.6177			
B5	-1.0310	-1.0310	-.9576	-.9576	-.9576	-.9576	-.9576	-.9576	-.9576			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	38	41	42	46	53	58	63	61	58	50	43	39
QHOR:	279	496	876	1283	1586	1754	2017	1689	1174	613	329	226

SEATTLE, WASHINGTON												
ELEVATION = 400												
LAT = 47.4												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	NA	81.39	40.94	24.11	15.97	11.91	9.50	7.90	5.91			
VT2/DD	NA	69.50	34.84	20.52	13.64	10.17	8.11	6.75	5.05			
VT3/DD	NA	60.35	30.23	17.80	11.84	8.83	7.05	5.86	4.38			
MONTHLY DD	14	89	203	345	456	611	766	921	1231			
ANNUAL DD	16	284	732	1500	2585	3957	5531	7223	10773			
PARAMETER A	NA	.782	.890	.954	1.039	1.121	1.179	1.212	1.235			
AZIMUTH AND TILT COEF.												
A1	NA	-.0226	-.0415	-.0414	-.0248	-.0230	-.0227	-.0234	-.0260			
A2	NA	.2407	.0189	.0600	.2787	.2735	.2776	.2914	.3280			
A3	NA	-.1809	-.0879	-.1312	-.2629	-.2711	-.2892	-.3171	-.3779			
A4	NA	.1706	.0679	.1006	.2208	.2234	.2338	.2519	.2931			
A5	NA	.0653	-.0824	-.0811	.0266	.0132	-.0004	-.0133	-.0347			
B1	NA	.0271	.0391	.0391	.0271	.0271	.0271	.0271	.0271			
B2	NA	-1.0026	-.8681	-.8681	-1.0026	-1.0026	-1.0026	-1.0026	-1.0026			
B3	NA	.7267	.6176	.6176	.7267	.7267	.7267	.7267	.7267			
B4	NA	.5384	.6664	.6664	.5384	.5384	.5384	.5384	.5384			
B5	NA	-1.0356	-.9747	-.9746	-1.0357	-1.0357	-1.0356	-1.0357	-1.0357			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	38	42	42	46	53	59	62	63	58	51	46	40
QHOR:	278	466	897	1294	1647	1766	1997	1679	1147	637	329	201

SPOKANE, WASHINGTON												
ELEVATION = 2365												
LAT = 47.6												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	64.12	24.41	17.33	13.41	10.93	9.23	7.99	7.04	5.69			
VT2/DD	54.80	20.86	14.81	11.46	9.34	7.89	6.83	6.02	4.86			
VT3/DD	47.59	18.11	12.86	9.95	8.12	6.85	5.93	5.22	4.22			
MONTHLY DD	143	376	530	685	840	995	1150	1305	1615			
ANNUAL DD	378	1338	2135	3113	4247	5540	6982	8536	11904			
PARAMETER A	.766	.983	1.048	1.107	1.159	1.210	1.255	1.291	1.333			
AZIMUTH AND TILT COEF.												
A1	.0171	.0051	.0028	.0017	.0013	.0011	.0010	.0009	.0008			
A2	.0392	.0657	.0786	.0931	.1079	.1205	.1330	.1469	.1810			
A3	-.0542	-.0861	-.1038	-.1235	-.1435	-.1611	-.1793	-.2003	-.2521			
A4	.0502	.0779	.0913	.1052	.1183	.1292	.1401	.1527	.1842			
A5	-.0277	-.0347	-.0393	-.0436	-.0473	-.0504	-.0541	-.0589	-.0716			
B1	.0264	.0264	.0264	.0264	.0264	.0264	.0264	.0264	.0264			
B2	-1.0527	-1.0527	-1.0527	-1.0527	-1.0527	-1.0527	-1.0527	-1.0527	-1.0527			
B3	.7594	.7593	.7594	.7594	.7594	.7594	.7594	.7593	.7594			
B4	.5239	.5239	.5239	.5238	.5239	.5238	.5238	.5239	.5239			
B5	-1.0526	-1.0527	-1.0526	-1.0526	-1.0527	-1.0526	-1.0526	-1.0527	-1.0526			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL												
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	28	33	37	45	56	62	68	68	59	46	35	27
QHOR:	313	578	1091	1521	1929	2110	2293	1942	1521	860	434	243

WHIDBEY ISLAND, WASHINGTON

		ELEVATION = 56								LAT = 48.3		
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
VT1/DD	NA	97.08	42.85	25.17	17.35	13.00	9.59	7.60	5.37			
VT2/DD	NA	82.72	36.51	21.44	14.79	11.04	8.15	6.46	4.57			
VT3/DD	NA	71.78	31.68	18.61	12.83	9.58	7.07	5.60	3.96			
MONTHLY DD	8	86	195	332	481	437	592	747	1057			
ANNUAL DD	14	221	557	1231	2296	3739	5424	7203	10838			
PARAMETER A	NA	1.099	1.153	1.123	1.116	1.171	1.269	1.350	1.402			
AZIMUTH AND TILT COEF.												
A1	NA	-.0189	-.0152	-.0195	-.0233	-.0838	-.0735	-.0694	-.0671			
A2	NA	.0293	.0492	.0853	.1235	-.0000	.0295	.0516	.0802			
A3	NA	-.0351	-.0545	-.0956	-.1444	-.0835	-.1129	-.1389	-.1757			
A4	NA	.0490	.0603	.0959	.1315	.1464	.1540	.1668	.1892			
A5	NA	-.0185	-.0149	-.0212	-.0293	-.1455	-.1341	-.1328	-.1366			
B1	NA	.0195	.0195	.0195	.0195	.0794	.0794	.0794	.0794			
B2	NA	-.9193	-.9193	-.9193	-.9193	-.7880	-.7880	-.7880	-.7880			
B3	NA	.6590	.6590	.6590	.6590	.5716	.5716	.5716	.5716			
B4	NA	.6158	.6158	.6158	.6158	.6470	.6470	.6470	.6470			
B5	NA	-.9770	-.9770	-.9770	-.9770	-.8769	-.8769	-.8769	-.8770			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 229339 QTA2 = 191576 QTA3 = 164964												
AZIMUTH AND TILT COEF. C1 = -.0707 C2 = -.3144 C3 = -.1899 C4 = 1.5023 C5 = -1.1387												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	39	42	43	48	51	56	57	61	61	51	44	45
QHOR:	266	536	962	1147	1720	1784	1786	1734	1323	615	347	206

YAKIMA, WASHINGTON

		ELEVATION = 1066								LAT = 46.6		
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
VT1/DD	63.62	30.55	22.51	17.51	14.24	11.98	10.34	9.09	7.33			
VT2/DD	54.33	26.09	19.22	14.95	12.16	10.23	8.83	7.77	6.26			
VT3/DD	47.18	22.65	16.69	12.98	10.56	8.88	7.67	6.74	5.43			
MONTHLY DD	184	383	520	668	822	977	1132	1287	1597			
ANNUAL DD	304	1070	1737	2601	3657	4863	6219	7699	10970			
PARAMETER A	.610	.886	.952	1.011	1.059	1.099	1.135	1.163	1.195			
AZIMUTH AND TILT COEF.												
A1	-.0170	-.0092	-.0042	-.0003	.0028	.0049	.0065	.0078	.0096			
A2	-.0461	-.0158	-.0095	.0349	.0612	.0847	.1066	.1301	.1830			
A3	.0066	-.0310	-.0605	-.0906	-.1230	-.1522	-.1808	-.2124	-.2877			
A4	-.0304	.0030	.0279	.0517	.0758	.0971	.1173	.1388	.1885			
A5	-.0236	-.0348	-.0407	-.0461	-.0517	-.0568	-.0622	-.0689	-.0866			
B1	-.0005	-.0005	-.0005	-.0005	-.0005	-.0005	-.0005	-.0005	-.0005			
B2	-1.0361	-1.0361	-1.0361	-1.0361	-1.0361	-1.0361	-1.0361	-1.0361	-1.0361			
B3	.7424	.7424	.7424	.7424	.7424	.7424	.7424	.7424	.7424			
B4	.6068	.6068	.6068	.6068	.6068	.6068	.6068	.6068	.6068			
B5	-1.0696	-1.0696	-1.0696	-1.0696	-1.0696	-1.0696	-1.0696	-1.0696	-1.0696			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 291377 QTA2 = 243071 QTA3 = 208984												
AZIMUTH AND TILT COEF. C1 = .0323 C2 = -.2975 C3 = -.3294 C4 = 1.6141 C5 = -1.2710												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	28	36	40	48	59	65	71	69	60	50	40	30
QHOR:	331	687	1161	1609	1965	2273	2337	2014	1492	886	444	298

CHARLESTON, WEST VIRGINIA

		ELEVATION = 951								LAT = 38.4		
SOUTH-VERT. (M= 1)		TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80		
VT1/DD	123.21	53.33	39.52	30.47	24.20	19.55	15.89	13.33	10.04			
VT2/DD	104.98	45.44	33.68	25.96	20.62	16.65	13.53	11.36	8.55			
VT3/DD	91.12	39.44	29.23	22.53	17.90	14.45	11.74	9.85	7.42			
MONTHLY DD	133	308	415	539	678	645	794	946	1255			
ANNUAL DD	289	907	1406	2034	2822	3768	4875	6159	9285			
PARAMETER A	.484	.570	.576	.575	.592	.631	.698	.759	.849			
AZIMUTH AND TILT COEF.												
A1	-.0037	-.0099	-.0146	-.0188	-.0218	-.0047	-.0064	-.0074	-.0091			
A2	.2807	.2958	.3552	.4135	.4471	.3761	.3742	.3831	.4332			
A3	-.2509	-.2863	-.3622	-.4349	-.4826	-.4703	-.4759	-.4959	-.5802			
A4	.1325	.1604	.2115	.2616	.2973	.4002	.3955	.4008	.4444			
A5	.0951	.0754	.0684	.0626	.0522	-.0970	-.0983	-.1022	-.1199			
B1	-.0019	-.0019	-.0019	-.0019	-.0019	-.0104	-.0104	-.0104	-.0104			
B2	-.9511	-.9511	-.9511	-.9511	-.9511	-.9181	-.9181	-.9181	-.9181			
B3	.6166	.6166	.6166	.6166	.6166	.6123	.6123	.6123	.6123			
B4	.7718	.7718	.7718	.7718	.7718	.7322	.7322	.7322	.7322			
B5	-1.1412	-1.1412	-1.1412	-1.1412	-1.1412	-1.0766	-1.0765	-1.0765	-1.0765			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL QTA1 = 228831 QTA2 = 190489 QTA3 = 163704												
AZIMUTH AND TILT COEF. C1 = -.0418 C2 = -.2327 C3 = -.3226 C4 = 1.6465 C5 = -1.1022												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	33	33	44	54	61	71	76	71	67	55	47	39
QHOR:	503	658	991	1389	1662	1843	1665	1503	1268	1005	595	400

EAU CLAIRE, WISCONSIN				ELEVATION = 896				LAT = 44.9				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	32.05	18.31	14.81	12.41	10.68	9.37	8.35	7.53	6.29			
VT2/DD	27.44	15.65	12.66	10.61	9.13	8.01	7.14	6.43	5.38			
VT3/DD	23.84	13.59	10.99	9.22	7.93	6.96	6.20	5.59	4.67			
MONTHLY DD	593	647	800	955	1110	1265	1420	1575	1885			
ANNUAL DD	1592	2982	3847	4813	5883	7068	8390	9858	13166			
PARAMETER A	.535	.735	.807	.871	.926	.976	1.023	1.065	1.125			
AZIMUTH AND TILT COEF.												
A1	-.0494	.0030	.0087	.0119	.0137	.0145	.0146	.0145	.0141			
A2	.3501	.1346	.1460	.1566	.1681	.1798	.1923	.2079	.2523			
A3	-.2615	-.2422	-.2443	-.2496	-.2588	-.2698	-.2831	-.3022	-.3623			
A4	.1594	.2094	.2041	.2019	.2034	.2068	.2122	.2216	.2552			
A5	.1150	-.1398	-.1229	-.1112	-.1033	-.0976	-.0939	-.0925	-.0978			
B1	.0227	.0132	.0132	.0132	.0132	.0132	.0132	.0132	.0132			
B2	-1.1424	-1.0727	-1.0727	-1.0727	-1.0727	-1.0727	-1.0727	-1.0727	-1.0727			
B3	.7824	.7708	.7707	.7707	.7707	.7707	.7707	.7707	.7707			
B4	.5833	.5661	.5661	.5661	.5661	.5661	.5661	.5661	.5661			
B5	-1.1910	-1.0924	-1.0924	-1.0924	-1.0924	-1.0924	-1.0924	-1.0924	-1.0924			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 260623	QTA2 = 217759			QTA3 = 187372				
AZIMUTH AND TILT COEF.				C1 = .0352	C2 = -.3317	C3 = -.2398	C4 = 1.4977	C5 = -1.1950				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	10	16	27	45	57	68	69	69	60	50	32	19
QHQR:	443	734	1091	1373	1706	1985	1867	1590	1201	815	439	312

GREEN BAY, WISCONSIN				ELEVATION = 702				LAT = 44.5				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	38.83	24.64	20.55	17.13	14.62	12.74	11.28	10.13	8.40			
VT2/DD	33.27	21.11	17.60	14.68	12.52	10.91	9.66	8.67	7.20			
VT3/DD	28.91	18.35	15.30	12.75	10.88	9.48	8.40	7.54	6.25			
MONTHLY DD	494	778	933	893	1046	1201	1356	1511	1821			
ANNUAL DD	1274	2564	3420	4394	5502	6757	8145	9677	13058			
PARAMETER A	.606	.623	.642	.697	.754	.805	.847	.880	.912			
AZIMUTH AND TILT COEF.												
A1	.1198	.1231	.1195	-.1425	-.1290	-.1188	-.1115	-.1060	-.1012			
A2	.2338	.3600	.4099	-.3879	-.3986	-.4155	-.4380	-.4670	-.5525			
A3	-.2111	-.3465	-.4013	-.3903	-.4111	-.4404	-.4764	-.5213	-.6465			
A4	.1151	.1959	.2288	.3188	.3231	.3344	.3516	.3753	.4467			
A5	.0465	.0554	.0590	-.0133	-.0139	-.0170	-.0220	-.0291	-.0490			
B1	-.0128	-.0128	-.0128	.0960	.0960	.0960	.0960	.0960	.0960			
B2	-1.1764	-1.1764	-1.1764	-1.1549	-1.1549	-1.1549	-1.1549	-1.1549	-1.1549			
B3	.8214	.8214	.8214	.8165	.8165	.8165	.8165	.8165	.8165			
B4	.5741	.5741	.5742	.5309	.5310	.5309	.5309	.5310	.5310			
B5	-1.1970	-1.1970	-1.1970	-1.1585	-1.1585	-1.1585	-1.1585	-1.1586	-1.1586			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 267987	QTA2 = 224010			QTA3 = 192781				
AZIMUTH AND TILT COEF.				C1 = .0354	C2 = -.3578	C3 = -.2145	C4 = 1.4900	C5 = -1.2010				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	14	19	30	44	54	64	69	67	58	50	35	21
QHQR:	437	729	1196	1416	1699	1856	1912	1598	1285	835	481	351

LA CROSSE, WISCONSIN				ELEVATION = 673				LAT = 43.9				
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M=1)	(M=1)	(M=1)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)	(M=12)			
VT1/DD	53.82	30.98	23.87	19.12	15.94	13.67	11.97	10.64	8.71			
VT2/DD	46.10	26.53	20.43	16.37	13.65	11.71	10.25	9.11	7.46			
VT3/DD	40.06	23.05	17.75	14.22	11.86	10.17	8.90	7.92	6.48			
MONTHLY DD	396	688	624	779	934	1089	1244	1399	1709			
ANNUAL DD	968	2236	3036	3938	4959	6117	7416	8859	12134			
PARAMETER A	.633	.506	.560	.630	.695	.752	.801	.844	.902			
AZIMUTH AND TILT COEF.												
A1	.0461	.1001	-.0286	-.0177	-.0108	-.0061	-.0027	-.0001	.0040			
A2	.3002	.5298	.4201	.4059	.4012	.4078	.4219	.4409	.5035			
A3	-.2504	-.4466	-.4258	-.4155	-.4191	-.4371	-.4638	-.4969	-.5953			
A4	.1525	.2572	.3787	.3549	.3443	.3457	.3548	.3693	.4225			
A5	.0752	.1405	-.0402	-.0331	-.0319	-.0342	-.0382	-.0439	-.0628			
B1	-.0655	-.0655	-.0231	-.0231	-.0231	-.0231	-.0231	-.0231	-.0231			
B2	-1.1720	-1.1720	-1.1422	-1.1422	-1.1422	-1.1422	-1.1422	-1.1422	-1.1422			
B3	.8021	.8021	.8079	.8079	.8079	.8079	.8079	.8079	.8079			
B4	.6090	.6090	.5631	.5631	.5631	.5631	.5631	.5631	.5631			
B5	-1.2114	-1.2113	-1.1461	-1.1461	-1.1461	-1.1461	-1.1462	-1.1461	-1.1461			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL				QTA1 = 264949	QTA2 = 221289			QTA3 = 190353				
AZIMUTH AND TILT COEF.				C1 = -.0002	C2 = -.3638	C3 = -.2190	C4 = 1.5471	C5 = -1.2170				
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	17	22	30	47	57	69	71	69	63	52	35	24
QHQR:	496	733	1068	1522	1646	2010	1876	1638	1211	886	479	361

MADISON, WISCONSIN												
ELEVATION = 860												
LAT = 43.1												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	48.61	29.89	24.63	20.39	16.95	14.51	12.68	11.26	9.20			
VT2/DD	41.60	25.58	21.08	17.47	14.53	12.43	10.87	9.65	7.89			
VT3/DD	36.14	22.22	18.31	15.18	12.62	10.80	9.44	8.39	6.85			
MONTHLY DD	439	714	867	765	920	1075	1230	1385	1695			
ANNUAL DD	1081	2359	3168	4074	5103	6261	7567	9029	12343			
PARAMETER A	.722	.588	.567	.596	.663	.721	.771	.815	.868			
AZIMUTH AND TILT COEF.												
A1	.0416	.0720	.0803	-.0537	-.0448	-.0383	-.0333	-.0293	-.0239			
A2	.2472	.3868	.4432	.7508	.6996	.6730	.6634	.6656	.7219			
A3	-.2145	-.3405	-.4004	-.8151	-.7700	-.7519	-.7534	-.7693	-.8663			
A4	.1635	.2551	.2920	.3934	.3760	.3719	.3777	.3908	.4514			
A5	.0510	.0767	.0805	.0434	.0324	.0224	.0126	.0022	-.0235			
B1	-.0352	-.0352	-.0352	.0129	.0129	.0129	.0129	.0129	.0129			
B2	-1.1337	-1.1337	-1.1337	-1.2116	-1.2116	-1.2116	-1.2116	-1.2116	-1.2116			
B3	-.7794	-.7795	-.7795	.8900	.8900	.8901	.8901	.8901	.8900			
B4	.6354	.6353	.6354	.5880	.5880	.5880	.5880	.5880	.5880			
B5	-1.2051	-1.2051	-1.2051	-1.1674	-1.1674	-1.1674	-1.1674	-1.1674	-1.1674			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 270444			QTA2 = 225882			QTA3 = 194314					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	17	21	28	47	58	67	71	68	62	50	36	25
QHOR:	520	804	1212	1383	1702	1874	1916	1750	1336	865	511	376

MILWAUKEE, WISCONSIN												
ELEVATION = 692												
LAT = 42.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	69.12	32.18	24.57	19.76	16.51	14.16	12.37	10.99	8.98			
VT2/DD	59.14	27.53	21.02	16.91	14.13	12.11	10.59	9.40	7.68			
VT3/DD	51.38	23.92	18.26	14.69	12.27	10.52	9.20	8.17	6.67			
MONTHLY DD	220	473	620	770	922	1076	1231	1386	1696			
ANNUAL DD	748	1891	2693	3623	4673	5865	7212	8708	12081			
PARAMETER A	.448	.598	.655	.709	.754	.795	.834	.868	.906			
AZIMUTH AND TILT COEF.												
A1	.0175	.0069	.0034	.0007	-.0012	-.0027	-.0039	-.0050	-.0072			
A2	.3690	.4239	.4409	.4542	.4696	.4868	.5033	.5232	.5941			
A3	-.4050	-.4558	-.4795	-.5028	-.5295	-.5587	-.5876	-.6213	-.7312			
A4	.2622	.2977	.3146	.3299	.3467	.3648	.3822	.4026	.4701			
A5	-.0204	-.0073	-.0102	-.0158	-.0222	-.0291	-.0364	-.0449	-.0699			
B1	.0264	.0264	.0264	.0264	.0264	.0264	.0264	.0264	.0264			
B2	-1.1121	-1.1121	-1.1121	-1.1121	-1.1121	-1.1121	-1.1121	-1.1121	-1.1121			
B3	.7744	.7743	.7743	.7743	.7743	.7743	.7743	.7743	.7743			
B4	.5819	.5820	.5820	.5820	.5820	.5820	.5820	.5820	.5820			
B5	-1.1475	-1.1475	-1.1475	-1.1475	-1.1475	-1.1475	-1.1475	-1.1475	-1.1475			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 265769			QTA2 = 221569			QTA3 = 190417					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	22	25	32	44	55	65	69	69	61	51	38	25
QHOR:	491	665	1122	1451	1746	2030	2017	1770	1325	884	551	377

CASPER, WYOMING												
ELEVATION = 5289												
LAT = 42.9												
	TB30	TB40	TB45	TB50	TB55	TB60	TB65	TB70	TB80			
SOUTH-VERT. (M= 1)	(M= 1)	(M= 1)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)			
VT1/DD	144.62	69.23	53.10	42.29	34.66	29.34	25.41	22.41	18.12			
VT2/DD	124.08	59.40	45.55	36.32	29.77	25.20	21.82	19.24	15.57			
VT3/DD	107.87	51.64	39.60	31.58	25.88	21.91	18.97	16.73	13.53			
MONTHLY DD	237	496	647	695	848	1002	1157	1312	1622			
ANNUAL DD	850	2112	3003	4046	5212	6496	7892	9404	12686			
PARAMETER A	.588	.561	.541	.538	.551	.557	.562	.563	.546			
AZIMUTH AND TILT COEF.												
A1	.0472	.0489	.0502	-.1371	-.1323	-.1289	-.1259	-.1235	-.1229			
A2	.5783	.7753	.8831	1.1575	1.2214	1.3027	1.3876	1.4837	1.7350			
A3	-.5950	-.8114	-.9309	-1.1876	-1.2826	-1.3974	-1.5171	-1.6509	-1.9887			
A4	.3501	.4783	.5486	.7613	.8111	.8728	.9375	1.0111	1.2030			
A5	.0400	.0482	.0515	.0739	.0588	.0436	.0275	.0098	-.0304			
B1	-.0140	-.0140	-.0140	.0439	.0439	.0439	.0439	.0439	.0439			
B2	-1.2354	-1.2354	-1.2353	-1.2759	-1.2759	-1.2759	-1.2759	-1.2759	-1.2759			
B3	.8138	.8138	.8138	.8813	.8813	.8813	.8813	.8813	.8813			
B4	.5818	.5818	.5818	.5087	.5087	.5087	.5087	.5087	.5087			
B5	-1.2895	-1.2895	-1.2895	-1.2656	-1.2656	-1.2656	-1.2656	-1.2656	-1.2656			
TOTAL ANNUAL TRANSMITTED RADIATION												
DUE SOUTH AND VERTICAL	QTA1 = 383547			QTA2 = 320620			QTA3 = 275659					
AZIMUTH AND TILT COEF.												
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TAVE:	24	28	31	38	51	62	72	71	56	47	33	27
QHOR:	678	1024	1452	1835	2230	2506	2573	2240	1698	1231	763	543

CHEYENNE, WYOMING

		ELEVATION = 6142								LAT = 41.2				
SOUTH-VERT. (M= 1)		(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)	(M= 2)				
VT1/DD	154.61	78.71	59.73	47.66	39.46	33.65	29.33	25.99	21.18	18.00				
VT2/DD	132.49	66.89	50.76	40.50	33.54	28.60	24.93	22.09	18.00	15.61				
VT3/DD	115.16	58.01	44.02	35.12	29.08	24.80	21.62	19.16	15.61	15.11				
MONTHLY DD	240	406	536	671	811	951	1091	1231	1371	1511				
ANNUAL DD	769	1859	2684	3678	4821	6120	7573	9141	10848	12548				
PARAMETER A	.550	.535	.525	.510	.496	.483	.473	.451	.431	.381				
AZIMUTH AND TILT COEF.														
A1	.0060	-.0285	-.0216	-.0128	-.0027	.0082	.0192	.0312	.0412	.0614				
A2	.5197	-.3609	-.2468	-.1243	.0077	.1518	.3072	.4865	.6445	.9445				
A3	-.5044	.1012	-.0383	-.1883	-.3483	-.5226	-.7134	-.9453	-1.1560	-1.5602				
A4	.3370	-.1028	-.0187	.0722	.1699	.2771	.3946	.5367	.7130	.9130				
A5	.0857	-.2242	-.2278	-.2313	-.2338	-.2373	-.2442	-.2619	-.3214	-.3214				
B1	-.0191	-.0081	-.0091	-.0081	-.0081	-.0081	-.0081	-.0081	-.0081	-.0081				
B2	-1.1763	-.8855	-.8854	-.8854	-.8854	-.8855	-.8855	-.8854	-.8854	-.8854				
B3	.7566	.3963	.3962	.3962	.3962	.3962	.3962	.3962	.3962	.3962				
B4	.6188	.9379	.9379	.9379	.9379	.9379	.9378	.9379	.9379	.9379				
B5	-1.3233	-1.3561	-1.3561	-1.3561	-1.3561	-1.3561	-1.3561	-1.3561	-1.3561	-1.3561				
TOTAL ANNUAL TRANSMITTED RADIATION														
DUE SOUTH AND VERTICAL		QTA1 = 370909			QTA2 = 310337			QTA3 = 266981						
AZIMUTH AND TILT COEF.		C1 = .0498			C2 = -.3840			C3 = -.2760			C4 = 1.5473		C5 = -1.3717	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
TAVE:	25	26	32	43	50	60	68	67	57	48	35	30		
QHOR:	743	1015	1483	1765	1953	2182	2195	1975	1686	1220	845	674		

ROCK SPRINGS, WYOMING

		ELEVATION = 6745								LAT = 41.6				
SOUTH-VERT. (M= 1)		(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)	(M= 12)				
VT1/DD	124.85	64.50	50.49	41.42	35.12	30.48	26.92	24.11	19.94	17.13				
VT2/DD	107.08	55.42	43.38	35.59	30.17	26.18	23.13	20.71	17.13	14.90				
VT3/DD	93.09	48.19	37.72	30.95	26.24	22.77	20.11	18.01	14.90	11.93				
MONTHLY DD	293	554	708	863	1018	1173	1328	1483	1638	1793				
ANNUAL DD	1089	2546	3528	4645	5882	7245	8729	10317	11941	13741				
PARAMETER A	.425	.446	.464	.473	.473	.471	.466	.452	.440	.404				
AZIMUTH AND TILT COEF.														
A1	-.1588	.0461	.0438	.0430	.0434	.0442	.0455	.0477	.0559	.0559				
A2	.5179	1.1718	1.2676	1.3842	1.5281	1.6793	1.8484	2.0589	2.6400	2.6400				
A3	-.5169	-1.0462	-1.1845	-1.3500	-1.5482	-1.7569	-1.9883	-2.2688	-3.0102	-3.0102				
A4	.2809	.6824	.7542	.8428	.9504	1.0639	1.1908	1.3470	1.7676	1.7676				
A5	.0451	.2009	.1816	.1585	.1342	.1084	.0808	.0516	-.0052	-.0052				
B1	.0603	.0094	.0094	.0094	.0094	.0094	.0094	.0094	.0094	.0094				
B2	-1.2331	-1.3026	-1.3026	-1.3026	-1.3026	-1.3026	-1.3026	-1.3026	-1.3026	-1.3026				
B3	.8005	.8890	.8889	.8890	.8890	.8889	.8890	.8889	.8889	.8890				
B4	.6197	.5295	.5295	.5295	.5295	.5295	.5295	.5295	.5295	.5295				
B5	-1.3053	-1.2975	-1.2975	-1.2975	-1.2975	-1.2975	-1.2975	-1.2975	-1.2975	-1.2975				
TOTAL ANNUAL TRANSMITTED RADIATION														
DUE SOUTH AND VERTICAL		QTA1 = 399262			QTA2 = 333558			QTA3 = 286689						
AZIMUTH AND TILT COEF.		C1 = .0467			C2 = -.3068			C3 = -.3973			C4 = 1.6346		C5 = -1.4079	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
TAVE:	22	22	29	38	49	58	68	66	56	43	30	22		
QHOR:	742	1072	1580	2021	2321	2558	2592	2237	1855	1328	826	640		

SHERIDAN, WYOMING

		ELEVATION = 3967								LAT = 44.8				
SOUTH-VERT. (M= 1)		(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 1)	(M= 12)				
VT1/DD	64.19	37.78	30.51	25.46	21.81	19.08	16.96	15.26	12.62	10.82				
VT2/DD	55.03	32.38	26.16	21.82	18.70	16.36	14.54	13.08	10.82	9.41				
VT3/DD	47.82	28.14	22.73	18.96	16.25	14.22	12.64	11.37	9.41	8.11				
MONTHLY DD	368	626	774	928	1083	1238	1393	1548	1628	1628				
ANNUAL DD	866	2051	2883	3858	4990	6277	7709	9256	10848	12593				
PARAMETER A	.812	.809	.787	.769	.762	.759	.757	.750	.724	.724				
AZIMUTH AND TILT COEF.														
A1	.0045	.0076	.0094	.0111	.0122	.0128	.0132	.0137	.0317	.0317				
A2	.1161	.2404	.3139	.3911	.4662	.5392	.6158	.7016	.9688	.9688				
A3	-.1082	-.2361	-.3171	-.4055	-.4955	-.5869	-.6863	-.7993	-1.1192	-1.1192				
A4	.0736	.1642	.2179	.2745	.3305	.3862	.4458	.5132	.7438	.7438				
A5	.0172	.0221	.0223	.0205	.0160	.0088	-.0016	-.0144	-.0552	-.0552				
B1	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001	-.0001	-.0076				
B2	-1.1912	-1.1912	-1.1912	-1.1912	-1.1912	-1.1912	-1.1912	-1.1912	-1.1912	-1.2166				
B3	.8170	.8171	.8170	.8170	.8171	.8170	.8170	.8170	.8170	.8589				
B4	.5522	.5522	.5522	.5522	.5522	.5522	.5522	.5522	.5522	.4997				
B5	-1.2152	-1.2152	-1.2152	-1.2152	-1.2152	-1.2152	-1.2152	-1.2152	-1.2152	-1.1927				
TOTAL ANNUAL TRANSMITTED RADIATION														
DUE SOUTH AND VERTICAL		QTA1 = 318069			QTA2 = 265990			QTA3 = 228848						
AZIMUTH AND TILT COEF.		C1 = .0255			C2 = -.3554			C3 = -.2704			C4 = 1.5311		C5 = -1.3015	
MONTH:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
TAVE:	20	29	33	43	53	61	69	70	57	47	34	27		
QHOR:	509	783	1201	1508	1864	2061	2349	2007	1479	1003	625	427		

APPENDIX C
BLANK WORKSHEETS

WORKSHEET 1
Schematic Design Parameters

BUILDING SIZE

Heated floor space: $A_{rf} = \text{_____ ft}^2$

Ceiling height: $h = \text{_____ ft}$

Total external perimeter: $P_{rt} = \text{_____ ft}^2$

NOTE: Include external perimeter of each floor.

External surface area: $A_{re} = 2A_{rf} + (P_{rt} \text{ [multiplied by] } h) = \text{_____}$

External surface-area-to-floor-area ratio: $A_{re}/A_{rf} = \text{_____}$

INSULATION LEVELS

Thermal resistance of the wall: $R_{wall} = \text{_____ deg.F-ft}^2$

NOTE: R_{wall} is obtained from the contour map in figure 13.

$$R_{wall} = \frac{1}{3} \left[\frac{A_{re}}{A_{rf}} \right] R_{wall} = \text{_____ deg.F-ft}^2$$

Thermal resistance of the roof: $R_{roof} = 1.5 R_{wall} = \text{_____ deg.F-ft}^2$

Thermal resistance of perimeter insulation: $\left. \begin{matrix} R_{perim} \\ \text{or} \\ R_{base} \end{matrix} \right\} = 0.75 R_{wall} = \text{_____ deg.F-ft}^2$

PASSIVE SYSTEM TYPE: _____

SOLAR APERTURE SIZE (DUE SOUTH ORIENTATION): $\left[\frac{A_{rc}}{A_{rf}} \right]_{ro} = \text{_____}$

NOTE: $\left[\frac{A_{rc}}{A_{rf}} \right]_{ro}$ is obtained from one of the contour maps in figures 14 through 16. Remember to convert from percent to fractional value before recording the quantity.

$$A_{rc} = \frac{A_{rf} \left[\frac{A_{rc}}{A_{rf}} \right]_{ro} \frac{A_{re}}{A_{rf}}}{3} = \text{_____ ft}^2$$

BUILDING ORIENTATION (AZIMUTH) [theta] = _____ degrees

NOTE: Azimuth is zero for due south and positive to the east.

WORKSHEET 2
Estimation of Net Load Coefficient

SPECIFIED DESIGN PARAMETERS

Total external perimeter: $P_{\tau\gamma} = \underline{\hspace{2cm}}$

Ground floor area: $A_{\gamma g\gamma} = \underline{\hspace{2cm}}$

Ground floor perimeter: $P_{\gamma g\gamma} = \underline{\hspace{2cm}}$

Roof area (horizontal projection): $A_{\gamma r\gamma} = \underline{\hspace{2cm}}$

South wall area: $A_{\gamma s\gamma} = \underline{\hspace{2cm}}$
NOTE: $A_{\gamma s\gamma}$ includes windows and solar apertures.

Ceiling height: $h = \underline{\hspace{2cm}}$

Nonsouth window fraction: $NSF = \underline{\hspace{2cm}}$

Number of glazings in nonsouth windows: $NGL_{\gamma n\gamma} = \underline{\hspace{2cm}}$

Air changes per hour: $ACH = \underline{\hspace{2cm}}$

Air density ratio (see figure 24): $ADR = \underline{\hspace{2cm}}$

CALCULATED DESIGN PARAMETERS

Nonsouth window area: $A_{\gamma n\gamma} = [P_{\tau\gamma} \text{ [multiplied by] } h) - A_{\gamma s\gamma}] NSF = \underline{\hspace{2cm}}$

Wall area: $A_{\gamma w\gamma} = (P_{\tau\gamma} \text{ [multiplied by] } h) - A_{\gamma c\gamma} - A_{\gamma n\gamma} NSF = \underline{\hspace{2cm}}$

NOTE: $A_{\gamma w\gamma}$ is the total area of all external walls excluding windows and solar apertures.

NET LOAD COEFFICIENTS

Walls: $LC_{\gamma w\gamma} = 24 A_{\gamma w\gamma} / RWALL = \underline{\hspace{2cm}}$

Nonsouth windows: $LC_{\gamma n\gamma} = 26 A_{\gamma n\gamma} / NGL_{\gamma n\gamma} = \underline{\hspace{2cm}}$

Pick One $\left\{ \begin{array}{l} \text{Perimeter (slab on grade):} \\ \text{Basement (heated):} \\ \text{Floor (over vented crawl space):} \end{array} \right.$

$LC_{\gamma p\gamma} = 100 P / (RPERIM + 5) = \underline{\hspace{2cm}}$
 $LC_{\gamma b\gamma} = 256 P_{\gamma g\gamma} / (RBASE + 8) = \underline{\hspace{2cm}}$
 $LC_{\gamma f\gamma} = 24 A_{\gamma g\gamma} / RFLOOR = \underline{\hspace{2cm}}$

Roof: $LC_{\gamma r\gamma} = 24 A_{\gamma r\gamma} / RROOF = \underline{\hspace{2cm}}$

Infiltration: $LC_{\gamma i\gamma} = 0.432$
(ACH [multiplied by] ADR [multiplied by] h [multiplied by] $A_{\gamma f\gamma}$) = $\underline{\hspace{2cm}}$

TOTAL: $NLC = LC_{\gamma w\gamma} + LC_{\gamma n\gamma} + (LC_{\gamma p\gamma} \text{ or } LC_{\gamma b\gamma} \text{ or } LC_{\gamma f\gamma}) + LC_{\gamma r\gamma} + LC_{\gamma i\gamma} = \underline{\hspace{2cm}}$

WORKSHEET 4
Base Temperature

CONSTANT THERMOSTAT SETTING

Thermostat setpoint: T_{rset} = _____

Base temperature:

$$T_{rb} = \frac{T_{rset} - \frac{Q_{rint}}{[NLC + (24 \text{ [multiplied by] } U_{rc} \text{ [multiplied by] } A_{rc})]}}{T_{rset} - \frac{Q_{rint}}{[NLC + (24 \text{ [multiplied by] } U_{rc} \text{ [multiplied by] } A_{rc})]}}$$
T_{rb} = _____

NIGHT TIME SETBACK

Daytime setpoint: T_{r1} = _____

Duration of daytime setpoint: hr_{r1} = _____

Night time setpoint: T_{r2} = _____

Duration of night time setpoint: hr_{r2} = _____

Average setpoint: $T_{rave} = T_{r1} (hr_{r1}/24) + T_{r2} (hr_{r2}/24)$ T_{rave} = _____

Building time constant:

$$[\tau] = \frac{24 \text{ HDC}}{[NLC + (24 \text{ [multiplied by] } U_{rc} \text{ [multiplied by] } A_{rc})]}$$
[tau] = _____

Effective thermostat setpoint:

$$T_{re} = T_{r1} - e^{-0.1[\tau]/24} (T_{r1} - T_{rave})$$
T_{re} = _____

Base temperature:

$$T_{rb} = \frac{T_{re} - \frac{Q_{rint}}{[NLC + (24 \text{ [multiplied by] } U_{rc} \text{ [multiplied by] } A_{rc})]}}{T_{re} - \frac{Q_{rint}}{[NLC + (24 \text{ [multiplied by] } U_{rc} \text{ [multiplied by] } A_{rc})]}}$$
T_{rb} = _____

WORKSHEET 5
Weather Parameters

LOCATION STATE: _____
CITY: _____

Annual heating degree days: $DD_{ra} =$ _____

FIRST SYSTEM

Number of glazings: NGL = _____
Orientation: [theta] = _____ degrees
Tilt: [open phi] = _____ degrees

South-vertical radiation to degree day ratio: $(VTn/DD)_{r0} =$ _____ Btu/ft²-DD

South-vertical city parameter: $a_{r0} =$ _____

Coefficients for azimuth/tilt convection:

A1 = _____ A2 = _____ A3 = _____ A4 = _____ A5 = _____

B1 = _____ B2 = _____ B3 = _____ B4 = _____ B5 = _____

Corrected city parameter:
(Use equation 5.16) $a_{r1} =$ _____

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_{r1} =$ _____ Btu/ft²-DD

SECOND SYSTEM

Number of glazings: NGL = _____
Orientation: [theta] = _____ degrees
Tilt: [open phi] = _____ degrees

South-vertical radiation to degree day ratio: $(VTn/DD)_{r0} =$ _____ Btu/ft²-DD

South-vertical city parameter: $a_{r0} =$ _____

Coefficients for azimuth/tilt convection:

A1 = _____ A2 = _____ A3 = _____ A4 = _____ A5 = _____

B1 = _____ B2 = _____ B3 = _____ B4 = _____ B5 = _____

Corrected city parameter:
(Use equation 5.16) $a_{r1} =$ _____

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_{r1} =$ _____ Btu/ft²-DD

MIXED WEATHER PARAMETERS

Radiation degree day ratio:
 $VTn/DD = f_{r1}(VTn/DD)_{r1} + f_{r2}(VTn/DD)_{r2} =$ _____ Btu/

City parameter: $a = f_{r1}a_{r1} + f_{r2}a_{r2} =$ _____

WORKSHEET 6
 Estimation of Auxiliary Heat Consumption

SCALED SOLAR LOAD RATIO

$$SLR^* = \frac{F (VT_n/DD) [\alpha]}{NLC/A_{TC} + G} \qquad SLR^* = \underline{\hspace{2cm}}$$

NOTE: All parameters in this expression are defined and recorded on Worksheets 2, 3, and 4.

ANNUAL HEAT-TO-LOAD-RATIO

$$(Q_{TA} / Q_{TL}) [\alpha] = \underline{\hspace{2cm}}$$

NOTE: The yearly heat-to-load ratio is obtained from the nomogram in figure 23. Using the value of SLR* calculated above and the city parameter a from Worksheet 5, one simply reads the heat-to-load ratio off the vertical axis of the nomogram.

ANNUAL AUXILIARY HEAT REQUIREMENT

$$Q_{TA} = (Q_{TA} / Q_{TL}) [\alpha] (NLC + G [\text{multiplied by}] A_{TC}) DD [\alpha] \qquad Q_{TA} = \underline{\hspace{2cm}}$$

WORKSHEET 7
 System Efficiencies During Reference Month

TOTAL SYSTEM EFFICIENCY

Total effective load coefficient:

$$TLC_{\tau e} = NLC + G \text{ [multiplied by] } A_{\tau c} = \text{_____ Btu/d}$$

Solar heating fraction:

$$SHF = 1 - e^{-SLR \cdot J} = \text{_____}$$

Total efficiency:

$$e_{\tau t} = \frac{TLC_{\tau e} \text{ [multiplied by] } SHF + (24 U_{\tau c} - G) A_{\tau c}}{[\text{alpha}] (VTn/DD) A_{\tau c}} = \text{_____}$$

(NOTE: $e_{\tau t} = e_{\tau d} \text{ [multiplied by] } e_{\tau u}$)

DELIVERY EFFICIENCY

$$e_{\tau d} = \text{_____}$$

UTILIZATION EFFICIENCY

$$e_{\tau u} = \frac{e_{\tau t}}{e_{\tau d}} = \text{_____}$$

WORKSHEET 8

Average Maximum Temperature During Reference Month

Delivered solar energy: $Q_{rD\gamma} = [\text{alpha}] [\text{multiplied by}] A_{rC\gamma}$
 $[\text{multiplied by}] e_{rD\gamma} [\text{multiplied by}] V_{Tn} [\text{multiplied by}] DD = \frac{\text{Btu}}{\text{month}}$

Excess solar energy: $Q_{rE\gamma} = (1 - e_{rU\gamma}) Q_{rD\gamma} = \frac{\text{Btu}}{\text{month}}$

Average temperature with
 ventilation (for night
 setback $T_{rset\gamma} = T_{re\gamma}$):

$$\bar{T} = T_{rset\gamma} + [10 [\text{multiplied by}] SHF (1 - e_{rU\gamma})^{0.2}] = \text{deg.F}$$

Temperature increment without ventilation:

$$[W-DELTA]T_{rI\gamma} = \frac{Q_{rE\gamma}}{NDAY [\text{multiplied by}] DHC} = \text{deg.F}$$

Average maximum temperature
 without ventilation: $T_{rmax\gamma} = \bar{T} + [W-DELTA]T_{rI\gamma} = \text{deg.F}$

WORKSHEET 9
Annual Delivered Solar Energy

FIRST SYSTEM

Transmitted solar radiation: $(Q_{TAn})_{\tau_0\gamma} = \underline{\hspace{2cm}}$ Btu/ft²-yr

Coefficients for azimuth/tilt correction:

C1 = C2 = C3 = C4 = C5 =

Corrected transmitted solar radiation: $(Q_{TAn})_{\tau_1\gamma} = \underline{\hspace{2cm}}$ Btu/ft²-yr
(Use equation 5.20)

SECOND SYSTEM

Transmitted solar radiation: $(Q_{TAn})_{\tau_0\gamma} = \underline{\hspace{2cm}}$ Btu/ft²-yr

Coefficients for azimuth/tilt correction:

C1 = C2 = C3 = C4 = C5 =

Corrected transmitted solar radiation: $(Q_{TAn})_{\tau_2\gamma} = \underline{\hspace{2cm}}$ Btu/ft²-yr
(Use equation 5.20)

ANNUAL DELIVERED SOLAR ENERGY

$$(Q_{rD\gamma})_{\tau a\gamma} = [\text{alpha}] \text{ [multiplied by] } A_{\tau c\gamma} \text{ [multiplied by] } e_{\tau d\gamma} \text{ [multiplied by] } [f_{\tau 1\gamma} (Q_{TAn})_{\tau 1\gamma} + f_{\tau 2\gamma} (Q_{TAn})_{\tau 2\gamma}] = \underline{\hspace{2cm}} \text{ Btu/yr}$$

WORKSHEET 10
Annual Incremental Cooling Load

ANNUAL HEAT TO LOAD RATIO

(Use Worksheets 4, 5, and 6
with $T_{\text{set}} = T_{\text{max}} - 10$)

$$\left[\begin{array}{c} Q_{\text{A}} \\ Q_{\text{L}} \end{array} \right]_{\text{a}} = \underline{\hspace{2cm}}$$

ANNUAL AUXILIARY HEAT REQUIRED

(From Worksheet 6 with $T_{\text{set}} = T_{\text{max}} - 10$)

$$Q_{\text{A}} = \underline{\hspace{2cm}} \text{ Btu}$$

ANNUAL SOLAR HEATING FRACTION

$$\text{SHF}_{\text{a}} = 1 - \left[\begin{array}{c} Q_{\text{A}} \\ Q_{\text{L}} \end{array} \right]_{\text{a}} = \underline{\hspace{2cm}}$$

ANNUAL UTILIZATION EFFICIENCY

$$\frac{(e_{\text{u}})_{\text{a}} = [\text{TLC}_{\text{e}} \text{ [multiplied by] SHF}_{\text{a}} + (24 U_{\text{c}} - G) A_{\text{c}}] \text{ [multiplied by] DD}_{\text{a}}}{(Q_{\text{D}})_{\text{a}}} = \underline{\hspace{2cm}}$$

Note: Use: TLC_{e} from Worksheet 7
 U_{c} , G , and A_{c} from Worksheet 3
 DD_{a} from Worksheet 5
 $(Q_{\text{D}})_{\text{a}}$ from Worksheet 9

ACTUAL INDOOR TEMPERATURE (ANNUAL AVERAGE)

(Use: $T_{\text{set}} = T_{\text{max}} - 10$)

$$T_{\text{act}} = T_{\text{set}} + 10 \text{ SHF}_{\text{a}} \text{ [multiplied by] } (1 - e_{\text{u}})_{\text{a}}^{0.2} = \underline{\hspace{2cm}} \text{ deg.F}$$

ACTUAL ANNUAL DEGREE DAYS

(Use Worksheet No. 4 with
 $T_{\text{set}} = T_{\text{act}}$ to determine T_{b})

$$\text{DD}_{\text{act}} = \underline{\hspace{2cm}} \text{ deg.F-day}$$

ACTUAL ANNUAL HEAT LOAD

$$Q_{\text{act}} = (\text{NLC} + 24 U_{\text{c}} \text{ [multiplied by] } A_{\text{c}} \text{ [multiplied by] } \text{DD}_{\text{act}} = \underline{\hspace{2cm}} \text{ Btu}$$

INCREMENTAL COOLING LOAD

$$Q_{\text{I}} = Q_{\text{D}} + Q_{\text{A}} - Q_{\text{act}} = \underline{\hspace{2cm}} \text{ Btu}$$

APPENDIX D
EXAMPLE WORKSHEETSWORKSHEET 1
Schematic Design ParametersBUILDING SIZE

$$\text{Heated floor space:} \quad A_{rf} = \underline{6800} \text{ ft}^2$$

$$\text{Ceiling height:} \quad h = \underline{9} \text{ ft}$$

$$\text{Total external perimeter:} \quad P_{rt} = \underline{684} \text{ ft}$$

NOTE: Include external perimeter of each floor.

$$\text{External surface area: } A_{re} = 2A_{rf} + (P_{rt} \text{ [multiplied by] } h) = \underline{19,756} \text{ ft}^2$$

$$\text{External surface-area-to-floor-area ratio:} \quad A_{re}/A_{rf} = \underline{2.91}$$

INSULATION LEVELS

$$\text{Thermal resistance of the wall:} \quad R_{WALL} = \underline{22} \text{ deg.F-ft}^2\text{-h}$$

NOTE: R_{WALL} is obtained from the contour map in figure 13.

$$R_{WALL} = \frac{1}{3} \left[\frac{A_{re}}{A_{rf}} \right] R_{WALL} = \underline{21} \text{ deg.F-ft}^2\text{-h}$$

$$\text{Thermal resistance of the roof:} \quad R_{ROOF} = 1.5 R_{WALL} = \underline{32} \text{ deg.F-ft}^2\text{-h}$$

$$\text{Thermal resistance of perimeter insulation:} \quad \left[\begin{array}{l} R_{PERIM} \\ \text{or} \\ R_{BASE} \end{array} \right] = 0.75 R_{WALL} = \underline{16} \text{ deg.F-ft}^2\text{-h}$$

$$\text{PASSIVE SYSTEM TYPE:} \quad \underline{\text{Direct gain}}$$

$$\text{SOLAR APERTURE SIZE (DUE SOUTH ORIENTATION):} \quad \left[\frac{A_{rc}}{A_{rf}} \right]_{ro} = \underline{0.12}$$

NOTE: $\left[\frac{A_{rc}}{A_{rf}} \right]_{ro}$ is obtained from one of the contour maps in figures 14 through 16. Remember to convert from percent to fractional value before recording the quantity.

$$A_{rc} = \frac{\sqrt{A_{rf}^2 + A_{ro}^2}}{3} = \frac{791}{3} \text{ ft}^2$$

BUILDING ORIENTATION (AZIMUTH)

[theta] = 15 degrees

NOTE: Azimuth is zero for due south and positive to the east.

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APPENDIX D

WORKSHEET 2
Estimation of Net Load Coefficient

SPECIFIED DESIGN PARAMETERS

Total external perimeter:	$P_t = \underline{684} \text{ ft}$
Ground floor area:	$A_g = \underline{3,400} \text{ ft}^2$
Ground floor perimeter:	$P_g = \underline{342} \text{ ft}$
Roof area (horizontal projection):	$A_r = \underline{3,400} \text{ ft}^2$
South wall area: NOTE : A_s includes windows and solar apertures.	$A_s = \underline{2,664} \text{ ft}^2$
Ceiling height:	$h = \underline{9} \text{ ft}$
Nonsouth window fraction:	$NSF = \underline{0.05}$
Number of glazings in nonsouth windows:	$NGL_n = \underline{2}$
Air changes per hour:	$ACH = \underline{0.6}$
Air density ratio (see figure 24):	$ADR = \underline{1.0}$

CALCULATED DESIGN PARAMETERS

Nonsouth window area:	$A_n = [(P_t - A_s) \cdot NSF] = \underline{175} \text{ ft}^2$
Wall area:	$A_w = (P_t \cdot h) - A_s - A_n = \underline{5,190} \text{ ft}^2$
NOTE : A_w is the total area of all external walls excluding windows and solar apertures.	

NET LOAD COEFFICIENTS

Walls:	$LC_w = 24 A_w / R_{WALL} = \underline{5,931} \text{ Btu/DD}$
Nonsouth windows:	$LC_n = 26 A_n / NGL_n = \underline{2,275} \text{ Btu/DD}$
(Perimeter (slab on grade):	$LC_p = 100 P_g / (PREIM + 5) = \underline{1,629} \text{ Btu/DD}$
Pick One Basement (heated):	$LC_b = 256 P_g / (R_{BASE} + 8) = \underline{\hspace{2cm}} \text{ Btu/DD}$
(Floor (over vented crawl space):	$LC_f = 24 A_g / R_{FLOOR} = \underline{\hspace{2cm}} \text{ Btu/DD}$
Roof :	$LC_r = 24 A_r / R_{ROOF} = \underline{2,550} \text{ Btu/DD}$
Infiltration:	$LC_i = 0.432 (ACH \cdot ADR \cdot h \cdot A_f) = \underline{15,863} \text{ Btu/DD}$
TOTAL:	$NLC = LC_w + LC_n + (LC_p \text{ or } LC_b \text{ or } LC_f) + LC_r + LC_i = \underline{28,248} \text{ Btu/DD}$

WORKSHEET 3

System Parameters

THERMAL STORAGE

Effective heat capacity: $EHC/A_c = \underline{53.93} \text{ Btu/}^\circ\text{F-ft}^2$

(Direct gain or radiant heat panel only)

Diurnal heat capacity per ft^2 of aperture: $DHC/A_c = \underline{56.96} \text{ Btu/}^\circ\text{F-ft}^2$

FIRST SYSTEM

System type: _____

Direct gain

System number: _____

6442

Scale factor: _____

$F_1 = \underline{0.966}$

Effective aperture conductance (daily): _____

$F_1 = \underline{4.42} \text{ Btu/}^\circ\text{F-ft}^2\text{-day}$

Steady-state aperture conductance (hourly): _____

$u_{c1} = \underline{0.35} \text{ Btu/}^\circ\text{F-ft}^2\text{-hr}$

System solar absorptance: _____

$a_1 = \underline{0.97}$

Collection aperture area: _____

$A_{c1} = \underline{791} \text{ ft}^2$

SECOND SYSTEM

System type: _____

System number: _____

Scale factor: _____

$F_2 = \underline{\hspace{2cm}}$

Effective aperture conductance (daily): _____

$G_2 = \underline{\hspace{2cm}} \text{ Btu/}^\circ\text{F-ft}^2\text{-day}$

Steady-state aperture conductance (hourly): _____

$u_{c2} = \underline{\hspace{2cm}} \text{ Btu/}^\circ\text{F-ft}^2\text{-hr}$

System solar absorptance: _____

$a_2 = \underline{\hspace{2cm}}$

Collection aperture area: _____

$A_{c2} = \underline{\hspace{2cm}} \text{ ft}^2$

FIRST SYSTEM AREA FRACTION

$$f_1 = A_{c1} / (A_{c1} + A_{c2})$$

SECOND SYSTEM AREA FRACTION

$$f_2 = A_{c2} / (A_{c1} + A_{c2})$$

MIXED SYSTEM PARAMETERS

Scale factor: _____

$$F = (f_1 \checkmark F_1) + (f_2 \bullet F_2) = \underline{\hspace{2cm}}$$

Effective aperture
conductance (daily): _____

$$G = (f_1 \bullet G_1) + (f_2 \checkmark G_2) = \underline{\hspace{2cm}} \text{ Btu/}^\circ\text{F-ft}^2\text{-day}$$

Steady-state aperture
conductance (hourly): _____

$$U_c = (f_1 \checkmark U_{c1}) + (f_2 \bullet U_{c2}) = \underline{\hspace{2cm}} \text{ Btu/}^\circ\text{F-ft}^2\text{-hr}$$

System solar absorptance: _____

$$a = (f_1 \bullet a_1) + (f_2 \checkmark a_2) = \underline{\hspace{2cm}}$$

Collection aperture area: _____

$$A_c = A_{c1} + A_{c2} = \underline{\hspace{2cm}} \text{ ft}^2$$

WORKSHEET 4
Base Temperature

CONSTANT THERMOSTAT SETTING

Thermostat setpoint: $T_{rset\gamma} = \underline{\hspace{2cm}}$

Base temperature:

$T_{rb\gamma} =$

$$T_{rset\gamma} - \frac{Q_{rint\gamma}}{[NLC + (24 \text{ [multiplied by] } U_{rc\gamma} \text{ [multiplied by] } A_{rc\gamma})]}$$

$T_{rb\gamma} = \underline{\hspace{2cm}}$

NIGHT TIME SETBACK

Daytime setpoint: $T_{r1\gamma} = \underline{70}$

Duration of daytime setpoint: $hr_{r1\gamma} = \underline{17}$

Night time setpoint: $T_{r2\gamma} = \underline{60}$

Duration of night time setpoint: $hr_{r2\gamma} = \underline{7}$

Average setpoint: $T_{rave\gamma} = T_{r1\gamma} (hr_{r1\gamma}/24) + T_{r2\gamma} (hr_{r2\gamma}/24)$ $T_{rave\gamma} = \underline{67.}$

Building time constant:

24 DHC

$$[\tau] = \frac{24 \text{ DHC}}{[NLC + (24 \text{ [multiplied by] } U_{rc\gamma} \text{ [multiplied by] } A_{rc\gamma})]}$$

$[\tau] = \underline{30.}$

Effective thermostat setpoint:

$$T_{re\gamma} = T_{r1\gamma} - e^{L - 0.1[\tau]/24} (T_{r1\gamma} - T_{rave\gamma})$$

$T_{re\gamma} = \underline{67.}$

Base temperature:

$$T_{rb\gamma} = T_{re\gamma} - \frac{Q_{rint\gamma}}{[NLC + (24 \text{ [multiplied by] } U_{rc\gamma} \text{ [multiplied by] } A_{rc\gamma})]}$$

$T_{rb\gamma} = \underline{60}$

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APPENDIX D

WORKSHEET 5
Weather Parameters

LOCATION STATE : VIRGINIA
CITY : NORFOLK

Annual heating degree days: $DD_a = \underline{2,778}$

FIRST SYSTEM

Number of glazings: $NGL = \underline{2}$
Orientation: $\theta = \underline{15}$ degrees
Tilt: $\phi = \underline{0}$ degrees
South-vertical radiation to degree day ratio: $(VTn/DD)_1 = \underline{27.60}$ Btu/ft²-I
South-vertical city parameter: $a_0 = \underline{0.637}$

Coefficients for azimuth/tilt convection:
A1 = -0.1572 A2 = -0.4382 A3 = 0.3078 A4 = -0.0848 A5 = -0.2437
B1 = 0.0885 B2 = -0.7389 B3 = 0.3319 B4 = 1.054 B5 = -1.159

Corrected city parameter:
(Use equation 5.16) $a_1 = \underline{0.616}$

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_1 = \underline{27.51}$ Btu/ft²-I

SECOND SYSTEM

Number of glazings: $NGL = \underline{\hspace{2cm}}$
Orientation: $\theta = \underline{\hspace{2cm}}$ degrees
Tilt: $\phi = \underline{\hspace{2cm}}$ degrees
South-vertical radiation to degree day ratio: $(VTn/DD)_1 = \underline{\hspace{2cm}}$ Btu/ft²-I
South-vertical city parameter: $a_0 = \underline{\hspace{2cm}}$

Coefficients for azimuth/tilt convection:
A1 = A2 = A3 = A4 = A5 =
B1 = B2 = B3 = B4 = B5 =

Corrected city parameter:
(Use equation 5.16) $a_1 = \underline{\hspace{2cm}}$

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_1 = \underline{\hspace{2cm}}$ Btu/ft²-I

MIXED WEATHER PARAMETERS

Radiation degree day ratio:
 $VTn/DD = f_1(VTn/DD)_1 + f_2(VTn/DD)_2 = \underline{\hspace{2cm}}$ Btu/ft²-I

City parameter: $a = f_1 a_1 + f_2 a_2 = \underline{\hspace{2cm}}$

WORKSHEET 6

Estimation of Auxiliary Heat Consumption

SCALED SOLAR LOAD RATIO

$$SLR^* = \frac{F (VTn/DD) [\alpha]}{NLC/A_{TC} + G} \qquad SLR^* = \underline{0.64}$$

NOTE: All parameters in this expression are defined and recorded on Worksheets 2, 3, and 4.

ANNUAL HEAT-TO-LOAD-RATIO

$$(Q_{TA} / Q_{TL})_{Ta} = \underline{0.37}$$

NOTE: The yearly heat-to-load ratio is obtained from the nomogram in figure 23. Using the value of SLR^* calculated above and the city parameter a from Worksheet 5, one simply reads the heat-to-load ratio off the vertical axis of the nomogram.

ANNUAL AUXILIARY HEAT REQUIREMENT

$$Q_{TA} = (Q_{TA} / Q_{TL})_{Ta} (NLC + G \text{ [multiplied by] } A_{TC}) DD_{Ta} \qquad Q_{TA} = \underline{32.6 \times 10}$$

WORKSHEET 7

System Efficiencies During Reference Month

TOTAL SYSTEM EFFICIENCY

Total effective load coefficient:

$$TLC_{\tau e\gamma} = NLC + G \text{ [multiplied by] } A_{\tau c\gamma} = \underline{31,744 \text{ Btu/d}}$$

Solar heating fraction:

$$SHF = 1 - e^{L - SLR * J} = \underline{0.47}$$

Total efficiency:

$$e_{\tau t\gamma} = \frac{TLC \text{ [multiplied by] } SHF + (24 U_{\tau c\gamma} - G) A_{\tau c\gamma}}{[\text{alpha}] (VTn/DD) A_{\tau c\gamma}} = \underline{0.86}$$

(NOTE: $e_{\tau t\gamma} = e_{\tau d\gamma}$ [multiplied by] $e_{\tau u\gamma}$)DELIVERY EFFICIENCY

$$e_{\tau d\gamma} = \underline{1.0}$$

UTILIZATION EFFICIENCY

$$e_{\tau u\gamma} = \frac{e_{\tau t\gamma}}{e_{\tau d\gamma}} = \underline{0.86}$$

WORKSHEET 8

Average Maximum Temperature During Reference Month

Delivered solar energy:

$$Q_{rD\gamma} = [\alpha] [\text{multiplied by}] A_{rC\gamma} [\text{multiplied by}] e_{rD\gamma} [\text{multiplied by}] \frac{VTn [\text{multiplied by}] DD = 12.1 \times 10^6 \text{ J}}{DD} \frac{\text{Bt}}{\text{mon}}$$

Excess solar energy:

$$Q_{rE\gamma} = (1 - e_{ru\gamma}) Q_{rD\gamma} = 1.69 \times 10^6 \text{ J} \frac{\text{Bt}}{\text{mon}}$$

Average temperature with
ventilation (for night
setback $T_{rset\gamma} = T_{re\gamma}$):

$$\bar{T} = T_{rset\gamma} + [10 [\text{multiplied by}] SHF (1 - e_{ru\gamma}) \text{ } ^{\circ}0.2^{\circ}] = \underline{70.7}$$

Temperature increment without ventilation:

$$[W-DELTA]T_{rI\gamma} = \frac{Q_{rE\gamma}}{NDAY [\text{multiplied by}] DHC} = \underline{1.3} \text{ d}$$

Average maximum temperature
without ventilation:

$$\bar{T}_{rmax\gamma} = \bar{T} + [W-DELTA]T_{rI\gamma} = \underline{72.0} \text{ d}$$

WORKSHEET 9
Annual Delivered Solar Energy

FIRST SYSTEM

Transmitted solar radiation: $(Q_{TAn})_{\tau_0} = \underline{232,584}$ Btu/ft²-yr

Coefficients for azimuth/tilt correction:

C1 = 0.046 C2 = -0.2934 C3 = -0.3243 C4 = 1.6957 C5 = -1.1985

Corrected transmitted solar radiation: $(Q_{TAn})_{\tau_1} = \underline{231,210}$ Btu/ft²-yr
(Use equation 5.20)

SECOND SYSTEM

Transmitted solar radiation: $(Q_{TAn})_{\tau_0} = \underline{\hspace{2cm}}$ Btu/ft²-yr

Coefficients for azimuth/tilt correction:

C1 = C2 = C3 = C4 = C5 =

Corrected transmitted solar radiation: $(Q_{TAn})_{\tau_1} = \underline{\hspace{2cm}}$ Btu/ft²-yr
(Use equation 5.20)

ANNUAL DELIVERED SOLAR ENERGY

$(Q_{rD})_{ra} = [\text{alpha}] [\text{multiplied by}] A_{rc} [\text{multiplied by}] e_{rd} [\text{multiplied by}]$
 $[f_{r1} (Q_{TAn})_{\tau_1} + f_{r2} (Q_{TAn})_{\tau_2}] = \underline{177.4 \times 10^6}$ Btu/yr

WORKSHEET 10
Annual Incremental Cooling Load

ANNUAL HEAT TO LOAD RATIO

(Use Worksheets 4, 5, and 6
with $T_{\text{set}} = T_{\text{max}} - 10$)

$$\left[\begin{array}{c} Q_{\text{A}} \\ \frac{Q_{\text{A}}}{Q_{\text{L}}} \end{array} \right]_{\text{a}} = \frac{0.37}{\underline{\hspace{2cm}}}$$

ANNUAL AUXILIARY HEAT REQUIRED

(From Worksheet 6 with $T_{\text{set}} = T_{\text{max}} - 10$)

$$Q_{\text{A}} = \frac{32.6 \times 10}{\underline{\hspace{2cm}}}$$

ANNUAL SOLAR HEATING FRACTION

$$\text{SHF}_{\text{a}} = 1 - \left[\begin{array}{c} Q_{\text{A}} \\ \frac{Q_{\text{A}}}{Q_{\text{L}}} \end{array} \right]_{\text{a}} = \frac{0.63}{\underline{\hspace{2cm}}}$$

ANNUAL UTILIZATION EFFICIENCY

$(e_{\text{u}})_{\text{a}} =$

$$\frac{[\text{TLC}_{\text{e}} \text{ [multiplied by] SHF}_{\text{a}} + (24 U_{\text{c}} - G) A_{\text{c}}] \text{ [multiplied by] DD}_{\text{a}}}{(Q_{\text{D}})_{\text{a}}} = \frac{0.}{\underline{\hspace{2cm}}}$$

Note: Use: TLC_{e} from Worksheet 7

U_{c} , G , and A_{c} from Worksheet 3

DD_{a} from Worksheet 5

$(Q_{\text{D}})_{\text{a}}$ from Worksheet 9

ACTUAL INDOOR TEMPERATURE (ANNUAL AVERAGE)

(Use: $T_{\text{set}} = T_{\text{max}} - 10$)

$$T_{\text{act}} = T_{\text{set}} + 10 \text{ SHF}_{\text{a}} \text{ [multiplied by] } (1 - e_{\text{u}})^{0.2} = \frac{75.8 \text{ d}}{\underline{\hspace{2cm}}}$$

ACTUAL ANNUAL DEGREE DAYS

(Use Worksheet No. 4 with
 $T_{\text{set}} = T_{\text{act}}$ to determine T_{db})

$$\text{DD}_{\text{act}} = \frac{3,827 \text{ d}}{\underline{\hspace{2cm}}}$$

ACTUAL ANNUAL HEAT LOAD

$$Q_{\text{act}} = (\text{NLC} + 24 U_{\text{c}} \text{ [multiplied by] } A_{\text{c}}) \text{ [multiplied by] } \text{DD}_{\text{act}} = \frac{133.5 \times 1}{\underline{\hspace{2cm}}}$$

INCREMENTAL COOLING LOAD

$$Q_{\text{I}} = Q_{\text{D}} + Q_{\text{A}} - Q_{\text{act}} = \frac{76.5 \times 10}{\underline{\hspace{2cm}}}$$

Custodians:

Army - CE
Navy - YD
Air Force - 04

Preparing Activity:

Navy - YD
(Project FACR-0166)